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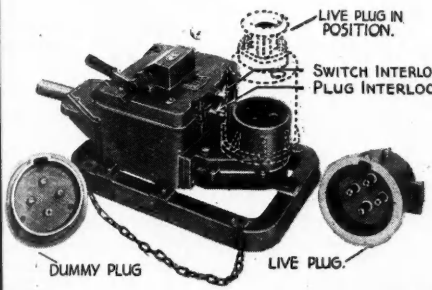

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THE
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THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

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Progress in Transmission

Developments of the Immediate Future

ALTHOUGH the past five years have been marked by a consolidation of previous achievements in transmission and distribution technique rather than by the introduction of outstanding novelties, there has, nevertheless, been enough advance in certain directions to suggest lines of development that are likely to be increasingly followed—in the more immediate future at any rate. In recognition of the growing complexity, and hence specialisation, of this branch of electrical engineering, the subject has been divided in the latest I.E.E. Progress Review into three parts, *viz.*:—High-voltage transmission, city distribution and rural distribution. We confine our attention here to some of the salient points in the first of these, which has been dealt with by Mr. F. H. Sharpe.

No higher voltage than the 287 kV adopted for the Boulder Dam-Los Angeles lines appears to be under contemplation anywhere. Possibly this represents the high-water mark for AC transmission beyond which DC may offer the most satisfactory solution. On this question we await the report of investigations now being carried out by Professor E. C. Starr in the United States. At present conversion from and inversion to AC, which is a limiting factor, is practicable only on a relatively small scale. While in Britain cable makers have not yet had opportunities for coping with voltages above 132 kV, they have shown by work abroad that they are fully able to design for any conditions to be anticipated here for a considerable time.

Questions of system stability (with which speed of circuit-breaker operation is bound up) will clearly continue to provide a field for the exercise of ingenuity in the application of the results of research. Lightning still remains a scourge of overhead systems, but much more is known about its characteristics, so that remedial measures should become progressively more effective. In this connection, the recent E.R.A. publication "Surge Phenomena," which was reviewed in our August 22nd issue, is a notable contribution to the literature of the subject.

Anti-fog insulators are showing marked superiority over other kinds in industrial districts. Live-line testing and washing at voltages as high as 132 kV have become regular procedure. Glaze and cement troubles in cap-and-pin insulators are now rare. Toughened glass is more widely used at medium voltages and is being tried at 132 kV, an advantage being that visual detection from the ground of faulty units is easy. Mr. Sharpe's suggestion that insulators should be date-marked when firing should mitigate trouble due to deterioration in service, since all those in the same batch can be replaced on the appearance of faulty examples.

Although pilot-wire protection still continues to give the most reliable service, available data shows that the performance of less costly systems has appreciably improved, particularly in speed of operation. Difficulties inherent in some of the

latter are being overcome by the adoption of carrier currents on an increasing scale. It is pleasing to find that few important switchboards are being installed to-day without provision for some form of bus-zone protection.

The importance of the developments referred to in the Review has to be gauged in relation to the conditions to be met in the next few years. These are likely to differ in degree rather than in kind from those prevailing now. Broadly, they are based on the stable running of more and larger interconnected generating units and the transmission of heavy loads for perhaps quite short distances under conditions in which Kelvin's Law has little relevance.

A Power-factor Question

How the power factor of an unbalanced three-phase load should be defined is a question that has not so far been answered in a way that appears to be generally acceptable. In this issue Professor G. W. O. Howe submits that transmission losses equivalent to those for balanced loading should be taken as a basis. Incidentally, his presentation of the pros and cons of alternative methods should appeal to all concerned with power-factor problems, apart from its relation to possible revision of the British Standard Glossary. As it is most desirable to obtain a consensus of opinion of electrical engineers on a subject that is a good deal less academic in its significance than might appear at first glance, we should welcome the views of our readers on Professor Howe's conclusions.

E.D.A. and Economy

THE war is inuring us to Gilbertian situations and consequently we see nothing very strange in an Electrical Development Association urging the public not to use electricity, or at least to use it very parsimoniously. This inversion of function has been forced upon the Association by the shortage of fuel upon which we have already commented. It is certainly much more desirable that economy should be secured in this way than that compulsory rationing should be instituted. All electricity undertakings have been approached by the Association with a suggestion that they should distribute to their consumers copies of a Mines Department leaflet giving economy hints and to attach to their accounts a slip emphasising the importance of economy. Within four days of the appeal replies were received from more than half of the undertakings asking for supplies of the leaflet and slip.

Science in Reconstruction

THE British Association Conference last week-end differed from others in not being mainly concerned with the dissemination of information of scientific development among the public. International in its aspect, it had as its main purpose the discussion of the contributions that science could make to a reconstructed world order which would, as Sir Richard Gregory expressed it, increase in strength and security through progressive scientific discoveries. This implies the intention of leading scientists to take more active responsibility for their discoveries in order to ensure that they are used for social betterment and for that only. By setting up Committees the Association is to give a lead in working out the difficult problems that will be encountered.

Curious Qualifications

DURING the past few years there has been an increasing tendency for people to append all kinds of mystic initials to their names. Generally there is no more harm in this than in the similar practice of members of the Pickwick Club, but occasionally money-making "institutions" with high-flown titles are set up by men who trade equally upon the vanity of those who should know better and the unfathomable gullibility of the public. The matter has been brought into prominence by a successful prosecution at Salford last week (reported in this issue). The "Royal Institution of Radio Engineers" was properly described as a ramp, but there are others which sail pretty close to the wind but manage to steer clear of the law.

Exaggerated Claims

WHILE the general superiority of fluorescent lighting over incandescent lamps is admitted, apparently extravagant claims for it are being made in the United States. Recently the Federal Power Commission ordered one company to cease using such phrases as "fluorescent daylight lights will cut your electric bills as much as 85 per cent." and "a 15-watt unit will replace any incandescent bulb up to 100 watts" as such statements tended to confuse or mislead purchasers.

Defining Power-Factor

The Case of an Unbalanced Three-phase Load

By Professor G. W. O. Howe,
D.Sc., M.I.E.E.

WHEN a three-phase load is balanced there is no difficulty in defining its power-factor, but when it is unbalanced this becomes a matter of considerable difficulty. Much has been written on the subject but without leading to any very definite decision. The British Standards Glossary throws no light on the subject, since it defines power-factor in terms of "equivalent volt-amperes" and these are then apparently defined in terms of the power-factor—a procedure known as "tail-chasing."

To simplify matters we shall assume sinusoidal voltages and currents and, unless

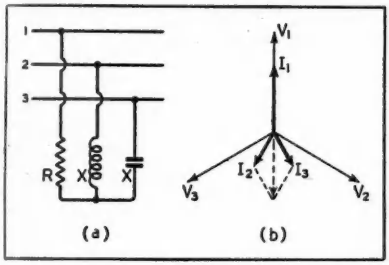


Fig. 1

otherwise stated, a symmetrical voltage system, so that the want of balance applies only to the currents. It will be helpful if we make the problem definite by considering several extreme, but simple, cases.

Fig. 1 (a) shows a star-connected load consisting of a non-reactive resistor of resistance R, a pure inductor and a pure capacitor each of reactance X. We assume that $X = \sqrt{3}R$ because then the star-point will be at zero voltage, so that even if there were a neutral wire it would carry no current. The voltages and currents are shown in fig. 1 (b). The real power supplied is I_1^2R or I_1V_1 ; there is no question about this, but when one turns to the equivalent volt-amperes or apparent power there are a number of alternatives. We shall consider the various definitions that have been put forward and apply them to this example.

(i) *Arithmetic Apparent Power.*[1]—This is the sum of the apparent powers obtained by multiplying line currents by voltages to neutral, either real or artificially made by three equal impedances. In our case we have $I_1V_1 + I_2V_2 + I_3V_3 = I_1V_1 + \frac{I_1}{\sqrt{3}}V_1 + \frac{I_1}{\sqrt{3}}V_1 = I_1V_1\left(1 + \frac{2}{\sqrt{3}}\right) = 2{\cdot}155\,I_1V_1$ and power-factor $= \frac{I_1V_1}{2{\cdot}155\,I_1V_1} = 0{\cdot}465$.

(ii) *Limiting Apparent Power*[1].—This is the maximum power that could be transmitted with currents not exceeding the heaviest line current. In our case this would be $3\,I_1V_1$ giving for the power-factor $\frac{I_1V_1}{3\,I_1V_1} = 0{\cdot}33$.

(iii) *Vector Power.*[1 2 3]—If P_1 P_2 P_3 are the real powers and Q_1 Q_2 Q_3 the reactive powers of the three phases (fig. 2) each with its proper sign, then the vector power $= \sqrt{P^2 + Q^2}$ where $P = P_1 + P_2 + P_3$ and $Q = Q_1 + Q_2 + Q_3$.

Power-factor $= \frac{P}{\sqrt{P^2 + Q^2}}$ (see fig. 2).

In our case $P = I_1V_1 + 0 + 0$ and $Q = 0 - I_2V_2 + I_3V_3 = 0$. So that the power-factor is unity. In deciding the sign of Q_2 and Q_3 a leading angle is taken as positive and a lagging angle as negative, but the opposite convention would give the same result.

(iv) *Algebraic Apparent Power* [1].—This is like the arithmetic apparent power but "algebraic" because some of the terms may be negative. The neutral point is a special one obtained by three unequal resistances, some of which may be negative. The ratio of the current in the resistance to the line current must be the same for all three lines, and to get this it may be necessary to use a negative resistance. In our present example this is not necessary, but one of the three resistances must be zero, *viz.*, that connected to phase 1; the other two resistances must be equal. The star-point is thus on conductor 1 and the algebraic apparent power $= (I_1 \times 0) + \left(\frac{I_1}{\sqrt{3}} \times \sqrt{3}V_1\right) + \left(\frac{I_2}{\sqrt{3}} \times \sqrt{3}V_1\right) = 2\,I_1V_1$. The power factor would thus be 0.5.

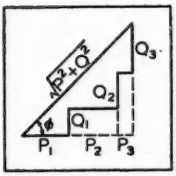


Fig. 2

This algebraic apparent power has a real physical basis. If the line currents remain

The numbers 1, 2, 3 refer to references given at the end of the article.

unchanged in magnitude, and therefore the transmission copper loss is also unchanged, what is the greatest amount of power that could be transmitted? To answer this question we replace the actual load by three non-reactive resistances and adjust them until the line ammeters read the same as before. If the voltages to this new star-point are V_1'', V_2'' and V_3'' the load is $I_1V_1''+I_2V_2''+I_3V_3''$. This is the maximum possible load with these currents. To find V_1'' V_2'' and V_3'' any three resistances will do, so long as they are in the correct ratio. A preferable method also based on equality of copper loss, follows.

(v) *Equivalent copper-loss balanced power-factor.*—If the same real power were transmitted as a balanced load, the power-factor necessary to cause the same total copper-loss in the lines as that caused by the unbalanced load can be regarded as the power-factor of the unbalanced load.

In our example, if the resistance of each line is R_l, the power wasted in the lines is $(I_1^2+I_2^2+I_3^2)\,R_l$ or $\frac{5}{3}I_1^2R_l$. For a balanced non-reactive load of the same real power as that of the unbalanced load, the current I would have to be $I_1/3$, and the power wasted in the lines would be $3\,I^2R_l$ or $\frac{1}{3}\,I_1^2R_l$. Hence the unbalancing of the load has increased the

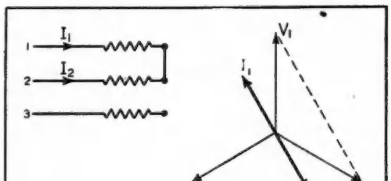


Fig. 3

line losses to five times their balanced non-reactive value.

If the load remained balanced but the power-factor of each phase were reduced to cos ϕ, the current for the same power would have to be increased to $I/\cos\phi$, and the line losses would be $\frac{1}{3}\,I_1^2R_l/\cos^2\phi$. Hence, in regard to line losses the load shown in fig. 1 has an effective power-factor of $1/\sqrt{5}$ or 0.447.

The values of the power-factor calculated in these various ways are collected for comparison in the table.

(vi) A station engineer might suggest yet another practical method. He knows exactly how the voltage regulation of the generator depends on the power-factor of the load when it is balanced, and he might suggest that the measured regulation with the unbalanced load would give its effective power-factor. In the case of the load shown in fig. 1 his test would indicate unity power-factor, since the regulation depends only upon the positive phase-sequence component. This is not surprising seeing that one phase has a 90 deg. lag and the other a 90 deg. lead. If he could make an accurate test of the armature heating he would obtain a very different result, *viz.*, the same as our equivalent copper-loss method.

CALCULATED POWER-FACTORS

Method	Fig. 1	Fig. 3	Fig. 4	Fig. 6
(i)	0.465	0.866	0.75	0.33
(ii)	0.33	0.577	0.56	0.33
(iii)	1.0	1.0	0.803	1.0
(iv)	0.5	1.0	0.803	0.33 (?)
(v)	0.447	0.707	0.686	0.31
(vi)	1.0	1.0	0.803	1.0

As a second example of an unbalanced load, take the case of the star-connection of three equal resistances, but with one of them open-circuited as shown in fig. 3 (a). Here the load consists entirely of non-reactive resistance and, as a single-phase load, would have unity power-factor, but not necessarily as a three-phase load. The voltages and currents are as shown in fig. 3 (b). The real power is $2\,I_1^2R$ or $\sqrt{3}V_1I_1$. According to definition (i) the power-factor $= \frac{P}{\Sigma\,(IV)} = \frac{\sqrt{3}V_1I_1}{2V_1I_1} = 0.866$.

According to (ii) it is $\frac{\sqrt{3}V_1I_1}{3V_1I_1} = 0.577$.

According to (iii) it is $\frac{P}{\sqrt{P^2+Q^2}} = 1$;

here again $Q = 0$ since in phase 1 $P = I_1V_1 \cos 30$ deg. and $Q = I_1V_1 \sin 30$ deg. ; while in phase 2 $P = I_1V_1 \cos -30$ deg. and $Q = I_1V_1 \sin -30$ deg.

To obtain the artificial star-point prescribed for definition (iv) it would be necessary to connect two equal resistances to lines 1 and 2 and an infinite resistance to line 3. The algebraic apparent power will be $I_1\frac{\sqrt{3}V_1}{2}$ in each phase, and the power-factor $= \frac{\sqrt{3}V_1I_1}{\sqrt{3}V_1I_1} = 1$, as it must be by this method, seeing that the load consists of non-reactive resistances.

The line losses are $2\,I_1^2R_l$. For a balanced non-reactive load of the same power the currents would be $I_1/\sqrt{3}$ and the line losses $I_1^2R_l$. If the power factor were cos ϕ, these line losses would be increased to $I_1^2R_l/\cos^2\phi$; hence for these to be equal to the actual line losses in accordance with definition (v) cos $\phi = 1/\sqrt{2} = 0.707$.

For definition (vi) it is necessary to resolve the currents into the positive and negative phase-sequence components. It is easy to

see that these are both $I/\sqrt{3}$, the positive in phase with the voltage and the negative necessarily wattless in the absence of a negative sequence voltage. So far as the voltage regulation of the generator is concerned the load would appear to have unity power-factor, since, as we have already seen, this depends only on the positive phase-sequence component.

One might feel inclined to argue that, since in fig. 3 the load is a non-reactive resistance and nothing else, the power-factor must necessarily be unity, but it must be remembered that even with a single-phase load, if the non-reactive resistance varies during the cycle and thus distorts the current wave, the power-factor is no longer unity although the load is

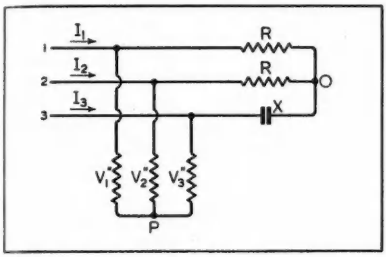


Fig. 4

non-reactive. Moreover, the same argument might also be applied to fig. 1 since phases 2 and 3 being equally lagging and leading might be supposed to cancel their reactive effects and leave a purely non-reactive transmission of unity power-factor. Such arguments will not appeal to the transmission engineer who has to provide the necessary conductors to carry the currents.

As a third example, consider the case illustrated in fig. 4 of a star-connected load consisting of two equal resistances and a condenser. For the sake of simplicity we shall assume that $X = \frac{1}{\omega C} = \frac{\sqrt{3}}{2}R$ because this brings the voltage of the star-point to the point O on the side of the voltage triangle, where BO = BC/4 (fig. 5). The voltages across the resistances are $V_1' = OA$ and $V_2' = OB$, and to a suitable scale these lines represent also the currents I_1 and I_2. The voltage across the condenser is $V_3' = OC$ and its current $I_3 = OD = 2OC/\sqrt{3}$.

If V is the line voltage, $V_1' = \frac{\sqrt{13}}{4}V$; $V_2' = \frac{V}{4}$; $V_3' = \frac{3V}{4}$. $I_1 = \frac{\sqrt{13}}{4}\frac{V}{R}$; $I_2 = \frac{1}{4}\frac{V}{R}$; $I_3 = \frac{3}{4}\frac{V}{X} = \frac{\sqrt{3}}{2}\frac{V}{R}$. Real power $= I_1V_1' + I_2V_2' = \frac{13}{16}\frac{V^2}{R} + \frac{1}{16}\frac{V^2}{R} = \frac{7}{8}\frac{V^2}{R}$

(i) *Arithmetic apparent power* $= I_1V_1 + I_2V_2 + I_3V_3$ (where V_1 V_2 V_3 are measured to the true neutral and not to the star-point) $= V_1\left(\frac{\sqrt{13}}{4} + \frac{1}{4} + \frac{\sqrt{3}}{2}\right)\frac{V}{R} = \frac{V^2}{\sqrt{3}R} \times 2.0175 = 1.165\frac{V^2}{R}$ and the power-factor $= 0.75$.

(ii) *Limiting apparent power* $= 3I_1V_1 = \frac{\sqrt{3} \cdot \sqrt{13}}{4}\frac{V^2}{R}$ and the power-factor $= \frac{7}{8}\frac{4}{\sqrt{39}} = 0.56$.

(iii) *Vector power.*—An inspection of fig. 5 shows that

$$P = P_1 + P_2 + P_3 = \frac{V_1^2}{R}\left(\frac{3}{2} + \frac{3}{8} + \frac{3}{4}\right) = \frac{V_1^2}{R} \cdot \frac{21}{8}$$

$$Q = Q_1 + Q_2 + Q_3 = \frac{V_1^2}{R}\left(\frac{\sqrt{3}}{4} + \frac{\sqrt{3}}{8} + \frac{3\sqrt{3}}{4}\right) = \frac{V_1^2}{R} \cdot \frac{9\sqrt{3}}{8}$$

and therefore the power-factor $= \frac{P}{\sqrt{P^2+Q^2}} = \frac{7}{\sqrt{49+27}} = \frac{7}{2\sqrt{19}} = 0.803$

(iv) *Algebraic apparent power.*—To determine this it is necessary to find the star-point P (fig. 4) of three resistances such that the currents taken by them will be in the same ratio as the actual line currents. Now the line current vectors form the closed triangle OBE; hence the currents in the three resistances, being in the same ratio, must form a similar triangle, and the three voltages PA, PB, PC, being in phase with the currents, must therefore form a similar star to the three main line currents. Hence if the star OA, OB, OD is drawn on tracing paper, it is only necessary to move it about until the three lines pass through the corresponding corners of the triangle ABC; this fixes the position of the point P, and the three star-voltages V_1'', V_2'', V_3''. P can be found by geometrical construction, but the tracing paper method is quicker. The maximum power possible with the given line currents is therefore $I_1V_1'' + I_2V_2'' + I_3V_3''$. Measurement from the diagram gives $V_1'' = 0.73V_1$, $V_2'' = 1.39V_1$, $V_3'' = 1.02V_1$, and for the power we find $\frac{V_1^2}{R}(1.14 + 0.6 + 1.53 = 3.27\frac{V_1^2}{R}$ giving a power-factor of $\frac{0.875}{1.09} = 0.803$, as found by the preceding method. This example shows that this definition of power-factor is, in general, not a simple one to apply.

(v) *Equivalent copper-loss balanced power-factor.*—The copper-loss in the lines $= (I_1^2 + I_2^2 + I_3^2)R_l = \left(\frac{13}{16} + \frac{1}{16} + \frac{3}{4}\right)\frac{V^2}{R^2} \cdot R_l = \frac{13}{8}\frac{V^2}{R^2}R_l$. For a balanced load of the same power and $\cos\phi = 1$, the line currents would be $\frac{7}{8}\frac{V_1}{R}$ and the line copper-loss $3\frac{49}{64}\frac{V_1^2}{R^2}R_l = \frac{49}{64}\frac{V^2}{R^2}R_l$. To bring this copper-loss up to the actual value, $\cos^2\phi$ would have to be reduced to $\frac{49}{104}$, giving a power-factor of 0.686.

(vi) *Generator regulation power-factor.*—The unbalanced system of currents in fig. 5 can be resolved into a balanced positive sequence system, with line currents having a power component of $\frac{7}{8}\frac{V_1}{R}$ and a leading wattless component of $\frac{3\sqrt{3}}{8}\frac{V_1}{R}$, and a balanced negative sequence system which has no effect on the regulation and can therefore be neglected. The regulation depends entirely on the positive sequence system, the power-factor of which is $\frac{7}{\sqrt{49+27}} = \frac{7}{\sqrt{76}} = 0.803$.

As a fourth example we shall consider the case of a four-wire three-phase system loaded as shown in fig. 6 (a) with three equal impedances but one a non-reactive resistor, one a pure inductor and the other a pure capacitor. The voltages and currents are shown in fig. 6 (b).

Since the actual star-point voltage is the neutral voltage and the three line currents are

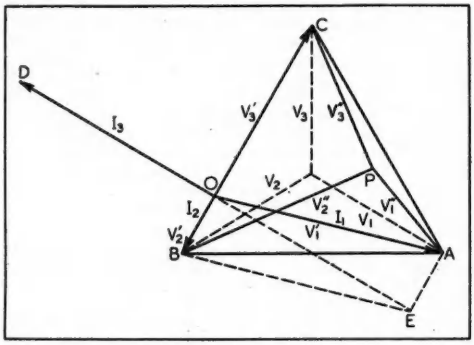


Fig. 5

equal, the special star-point required for the algebraic apparent power is the actual star-point, and methods (i), (ii) and (iv) give the same power-factor, *viz.*, $\frac{I_1V_1}{3I_1V_1} = 0.33$. Method (iv) is based, however, on the assumption that the magnitudes of the line currents are unchanged, and this is impossible in this case unless one ignores the neutral line. In method (iii), $P = P_1 = I_1V_1$ and $Q = Q_2 + Q_3 = -I_2V_2 + I_3V_3 = 0$ and therefore the power-factor $= \frac{P}{\sqrt{P^2+Q^2}} = 1$.

In applying method (v) the copper losses, if the same load were balanced, would be confined to the three-phase lines, since no current would then flow in the neutral line. To equate these losses to those actually occurring in the unbalanced system, it is necessary to make some assumption as to the cross-section of the neutral line. We shall assume that all lines have the same cross-section. From fig. 6 (b) $I_0 = I_1(\sqrt{3}-1) = 0.732I_1$ and the total copper loss $= 3I_1^2R_1 + (0.732I_1)^2R_1 = 3.536I_1^2R_1$. If the same load were balanced and of unity power-factor the line currents would be $\frac{I_1}{3}$ and the neutral current zero; the line copper-loss would be $\frac{I_1^2R_1}{3}$, but if the power-factor were $\cos\phi$ this would be increased to $\frac{I_1^2R_1}{3\cos^2\phi}$. Hence for equal copper loss $\cos^2\phi = 1/10.61$ and $\cos\phi = 0.31$.

If analysed into its symmetrical components, the system is found to consist of a positive sequence system with line currents of $I_1/3$ and $\cos\phi = 1$, a negative-sequence system with line currents of $\frac{I_1}{3}(\sqrt{3}+1)$ and a zero-sequence system with line currents of $\frac{I_1}{3}(\sqrt{3}-1)$. Whether the negative and zero systems are active or reactive it is impossible to say because there are no corresponding voltage systems with which to compare them, but they are certainly wattless and they do not affect the voltage regulation of the alternator. Method (vi) gives, therefore, a power-factor of unity.

It will be noticed that methods (iii) and (vi) always give the same result. This is referred to by Curtis and Silsbee who state that "the vector sum of the apparent powers of the symmetrical components is, for the unbalanced circuit, identical with the vector power as obtained by separating into a group of single-phase circuits."

With symmetrical voltage systems

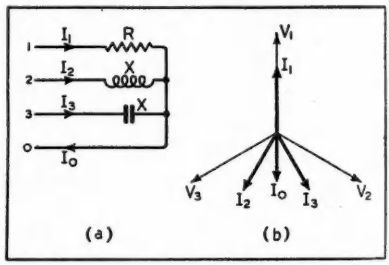


Fig. 6

the negative sequence component can have no power, real or reactive.

As a general definition of power-factor it would probably be agreed that methods (ii) (iii) and (vi) are unsuitable. Method (i) is simple to calculate but does not appear to

have any obvious physical significance. It is difficult to see any real reason for adding the volt-amperes in the three phases; it appears to be an arbitrary arithmetical convention, justified only by its simplicity.

Methods (iv) and (v) on the other hand have a very definite physical significance and are based upon an important engineering aspect of the transmission. Method (iv) gives unity power-factor for fig. 3 notwithstanding the extreme out of balance of the load, and it is of doubtful application in a 4-wire transmission, whereas method (v) always gives a reasonable figure and is applicable to a 4-wire transmission on the very reasonable assumption that all four wires have the same cross-section.

The fact that method (iv) gives unity power-factor for fig. 3 is sufficient to rule it out for the following reason. One of the reasons for adopting a tariff based on the power-factor is the dependence of the transmission losses and the heating of the generator and transformer windings on the power-factor. It is immaterial whether excessive losses and heating are due to phase displacement or to want of balance. Method (v) shows that the unbalance of the load in fig. 3 causes just the same losses and heating as a balanced load with a power-factor of 0.707. We are thus reduced to methods (i) and (v).

Now the examples that we have considered have all been extreme, and it is very unlikely that such cases will be met with in practice. When the want of balance is less pronounced these two methods will give less divergent results than those in the Table. It will be seen that method (i), *i.e.*, the simple arithmetic method, gives results in much closer agreement with (v), *i.e.*, the equivalent copper-loss method, than does any other method.

We are thus forced to the conclusion that unless one adopts the definition of power-factor based on that of the same balanced load to give the same transmission losses, in which case the power-factor is obtained by dividing the power by $V\sqrt{I_1^2+I_2^2+I_3^2+I_0^2}$ where V is the line voltage, one cannot do better than use the simple method of dividing the power by $(I_1V_1+I_2V_2+I_3V_3)$.

If considered desirable the three-phase power-factor could be regarded as the product of two factors, one a phase-angle factor and the other an unbalance factor, just as in the single-phase case it might be regarded as the product of a phase-angle factor and a distortion-factor.

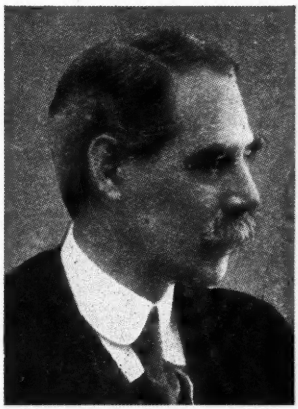
1. Curtis and Silsbee. El. Engg. 1935, p. 394.
2. Wagner and Evans. Symmetrical Components as applied to the analysis of unbalanced circuits. New York and London. 1933.
3. Neumann. Symmetrical Component Analysis. Pitman. 1939.

Mr. George Balfour

ONE of the greatest influences in the electricity supply world has been removed by the death, on September 26th, of Mr. George Balfour, M.P., M.I.E.E.

George Balfour was born at Portsmouth in 1872, and was educated at the local Technical College and at University College, Dundee. In 1909 he was instrumental in forming Balfour, Beatty & Co., Ltd., with the comprehensive objects of "carrying on business as general electrical engineers, contractors, operating managers for tramways, railways, lighting and power properties, and for the promotion of new enterprises." So thoroughly were these objects pursued that in a few years the company earned a world-wide reputation for the excellence of its large-scale constructional work. One notable achievement was the Kut Barrage, Iraq, constructed at a cost of £1,120,000 to control the waters of the Tigris for the purpose of irrigating a wide area.

In this country, as well as undertaking the erection of power stations, the Balfour interests secured control of some of the most important power concerns, largely through the Power Securities Corporation, Ltd., which was formed in 1922, with Mr. Balfour as chairman. The list of companies of which he was the head is an imposing one; the principal concerns were the London Power Co., Ltd., and its associates; the Lancashire Electric Light & Power Co., Ltd.; the Scottish Power Co., Ltd.; the Midland Counties Electric Supply Co., Ltd.; and the Perak River Hydro-Electric Power Co., Ltd.



The late Mr. G. Balfour

George Balfour had been Unionist member for Hampstead since 1918; he had previously (in 1910 and 1911) unsuccessfully contested the Govan Division of Lanarkshire. In Parliament he was a strong protestant against Government interference with industry (particularly the electricity supply industry) as he demonstrated when the 1919 and 1926 Electricity (Supply) Acts were before the House. He was chairman of a Committee on Cement Production appointed by Lord Reith.

In 1901 he married Miss Margaret Mathers, of Dundee, who, with four sons and a daughter, survives him.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Plans for Reorganisation

MR. DERENZI'S letter in your issue of September 5th is a helpful contribution to the discussion of plans for post-war reorganisation. I am fully aware of the existence of the Joint Committee of Electricity Supply Associations, but my suggestion was for "a committee composed of representatives of all the parties interested in electricity supply development." I submit that the parties so interested include in addition to supply undertakings, the manufacturers of electricity consuming equipment, the electrical contractors and the consulting engineers, all of whom come into almost daily association with each other.

The two cases which I referred to as "X" and "Y" occurred only seven years ago, but no useful purpose would be served by stating whether the undertakings concerned were company or municipally owned. It is interesting to have Mr. DeRenzi's views upon the present form of grid tariff.

When the prolonged discussion in your journal upon the subject of chief engineers' salaries is terminated, will it be too much to hope that some of the "parties interested" will contribute their views upon what Mr. DeRenzi has been good enough to describe as the "number of important points" raised in the article which appeared under my name in your issue of August 15th last?

*London, E.C.*1. J. J. LESSER.

A Standard Vehicle Battery

WITH reference to Mr. Outram's letter under this heading in your issue of August 29th I cannot allow some of the statements therein to pass unchallenged as they are misleading to your readers. How one size of battery—presumably he means by this the same number of cells of the same capacity—can propel a 60-cwt. van at the same speed and for the same distance as it would a 7-cwt. van is beyond comprehension.

To illuminate this point there are many vehicles on the road to-day capable of 22/25 MPH for a distance of 40/50 miles with an average payload of 7 cwt. The battery used weighs approximately 12½ cwt. (30 lead acid cells of 193-Ah capacity). The standard 60-cwt. electric lorry of to-day has a speed of 12/15 MPH, with a range of 35/40 miles, and to obtain this uses a battery weighing approximately 28 cwt.

Secondly, as I have already stated, there are many electric vehicles to-day having speeds up to 25 MPH and a range of 40/50 miles which refutes Mr. Outram's optimistic view of 13/15 MPH, but here a word of warning is necessary: the electric vehicle is not manufactured for a job where speed is an essential factor, but for local delivery work where there are frequent stops and where its rapid acceleration from rest to its maximum speed gives a big advantage over the internal combustion vehicle.

I do not agree that after deducting the cost of battery and charger the electric vehicle is lower in initial cost than the i.c. vehicle, nor will it be until the market is large enough to warrant mass production methods being used as in the i.c. industry. If Mr. Outram has a concrete plan for standardisation in the electric vehicle industry then we, and I think here I can speak for my fellow members of the N.W. Area Committee of the Electric Vehicle Association, would be only too pleased to examine and report on his plan.

There is no doubt that the number of electric vehicles in this country with its thickly-populated industrial areas is only a fraction of what it should be and we are far behind some other countries in this respect, notably Germany, who had in 1939 approximately 125 times as many electric vehicles as this country, the German Post Office alone running approximately the same number as there are registered in the whole of the United Kingdom —the reason, of course, being the use of the home-produced fuel.

Finally, I feel that the whole electrical industry should take a more active part and give the rest of the country a lead by using its own transport much more extensively than it does to-day.

Manchester. A. WALTON.

Pensions for Chief Engineers' Widows

THE widow of a late chief engineer (I.M.E.A. member) has been left destitute, mainly due to the fact that for some 25 years as "chief" he had been under-paid, as this undertaking never adopted the I.M.E.A. scale.

It is very peculiar that a huge industry like the electricity supply industry is so backward in this respect, leaving the widow of a former prominent member dependent upon the charity of relatives, or alternately faced with the prospect of the "Union."

Other organisations seem to cater very well for their widows, etc., as only last week, in the House of Commons, the Home Secretary announced an increase in allowances to widows and dependants of former members of the police force.

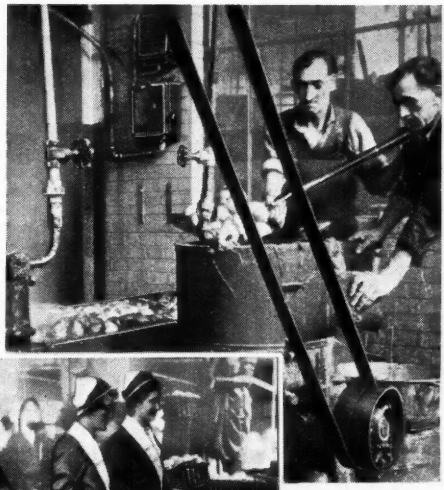
Darwen. SALESMAN.

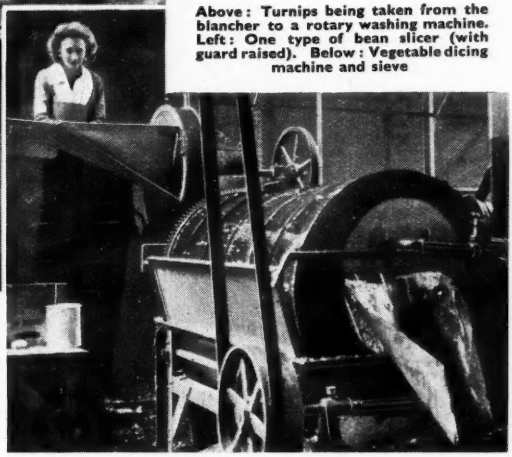
A Modern Cannery

How Fruits and Vegetables are Preserved

A FEW weeks ago we described how electricity is employed at one of the Ministry of Food's cold storage depots. Following a recent visit to one of the seven factories operated by Wisbech Produce Canners, Ltd., we are now able to deal with its application in another method of food preservation and storage, namely, the canning of fruits and vegetables. This one works alone has a daily output of about 10,000 cases of 24 cans, and so we can feel with some degree of confidence that the surplus of fresh vegetables and fruit is not being wasted and is being safely stored for consumption in the winter when the need will certainly be greater and the variation in diet thus made possible will be much more appreciated.

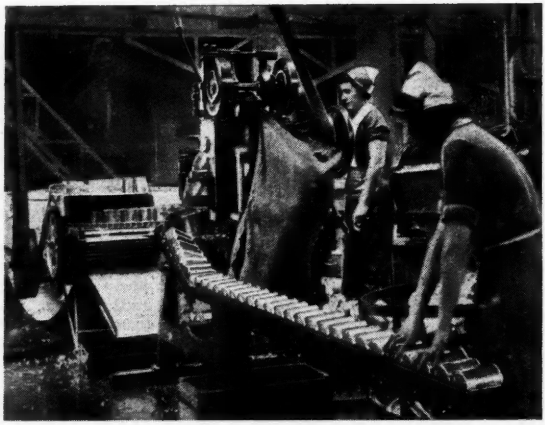
As the greater portion of the works has been in operation for only eighteen months most of the equipment is of the very latest type designed to ensure the maximum of both hygiene and output. Except for the raising of the steam utilised for the actual cooking preservation processes, electricity is well to the fore in all operations, everywhere saving time and labour. In these days of increasing use of individual electric drive, it is interesting to find an installation where, on account of the interdependence of the various processes involved and the need for synchronising them, the group drive from a single motor through belts and shafting still holds its own, being much more convenient and





Above: Turnips being taken from the blancher to a rotary washing machine. Left: One type of bean slicer (with guard raised). Below: Vegetable dicing machine and sieve

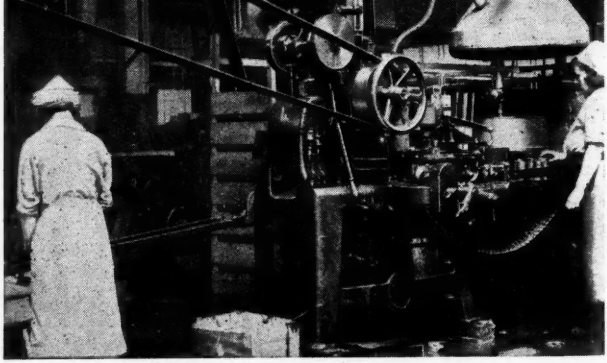
economical. A further advantage of belt drive in this particular instance is that, as much of the work is seasonal and some of the machines (*e.g.*, pea-viners, currant-



Cans of vegetables leaving the exhauster and sealing machine ready for cooking

stringers, bean-cutters, etc.), are used perhaps only for a few weeks of the year, the same motors can be utilised for a variety of different processes.

The different ways in which the various fruits and vegetables are prepared for canning are perhaps the most fascinating feature of the whole works. Fruits generally require little attention except washing and picking over by hand before being put straight into the cans travelling on conveyors; any fruit showing signs of softness is rejected, but this can generally be used up for jam. Goose-



Syruping (or soup filling) and sealing machines

berries are topped and tailed in carborundum-lined washing machines, the fruit being rubbed by a rotary motion against the inside. The stringing of black and red currants is effected by passing the fruit down a slotted incline through which arms gently pull off the stalks.

Vegetables usually need somewhat more attention. Carrots and turnips first go to a blancher, a rotary machine designed for the continuous pre-cooking of both kinds of vegetables simultaneously yet separately. This is one of the few machines possessing its own exclusive motor, which is a 3-HP Mather & Platt moisture proof unit mounted on top. The addition of a very small amount of caustic soda in the cooking water loosens the skins to facilitate their removal in rotary washers of the same type as those used for the gooseberries. Potatoes, after being washed in a specially-designed machine also have their skins removed in the same way.

Peas have to be first separated from their pods and foliage by means of viners. Elevators then take them through a series of riddles and they are then subjected to a strong draught to remove any dirt or dust. After being washed the peas are graded into six sizes by means of a machine comprising a series of drums each with perforations $\frac{1}{16}$ in. larger than the preceding one.

French and runner beans are, however, the most difficult of all to deal with. First they are graded into five sizes. This is done by thickness, not length, by means of an ingenious

rotary machine with slotted drums. Topping and tailing follows, the beans being revolved inside another slotted drum by means of a worm contrivance; the ends of the beans catch in the slots and are cut off by the knives on the outside. While this process is not infallible about 90 per cent. of the beans are satisfactorily dealt with, leaving only a small number to be done by hand on the conveyor belt inspection table (driven by a 10-HP English Electric motor). Two different types of cutter are used. In one the beans are pushed individually by hand into slots for three knives on a revolving plate to deal with. The other cutter incorporates a large number of knives, the beans being fed by conveyor on to revolving slotted drums through which the knives pass.

After being washed, the carrots, turnips, etc., have their tops and any blemishes removed by hand before passing on to the dicing machine, which, being in almost continuous use, possesses its own individual motor, a 5-HP, 1,000/940-RPM Mather & Platt induction machine. The small cubes of vegetables coming from the dicer are admitted, together with water, to a horizontal rotary washer where the small and perfectly shaped pieces are extracted through a cylindrical wire-mesh sieve to be used up for soups.

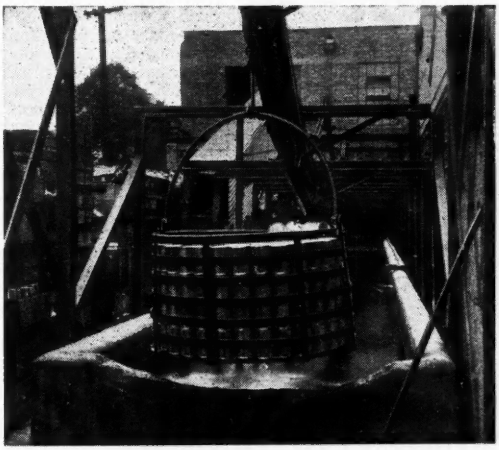
As already mentioned, the filling of the cans of fruit is done by hand, on five long filling benches, down the centre of each of which runs a conveyor. These conveyors, which are all driven through a reduction gear by a single English Electric motor with Allen West starter, feed any one of the five cooking lines which are situated at right-angles to the benches at the end of the main factory. This is a departure from the usual practice in which a particular filling table serves only one cooking line and it obviously possesses a number of advantages. Each cooking line normally handles a different sized can.

Exhausting and Cooking

The cans full of fruit go on these conveyors to the syrupers where the required amount of syrup is automatically admitted. Lids are then clinched on slackly, also automatically, and the cans pass to the exhausters. Here they are taken on a slowly moving conveyor through long covered tunnels where they are heated up by steam to expel any air before being automatically sealed ready for cooking. A single 8-HP English Electric motor serves all the syrupers and clinching machines.

Cooking is carried out by means of continuous cookers, the cans passing on conveyors through steam-heated compartments. The time taken for the cooking process varies, of course, with different kinds of fruits. All five of the cooking lines comprising exhausting, sealing, and continuous cooking machines, each one capable of dealing with 30,000 cans per day, are driven from the same 10-HP, 950-RPM English Electric motor.

The prepared vegetables are tipped into hoppers, where they are mixed if necessary.



A cage full of cans leaving the cooling trough

From the hoppers they are taken by means of a small bucket type elevator to the top of a machine which automatically fills the cans. The potato washer, the diced vegetable elevator and filler are driven by one motor, while another 9-HP, 1,035-RPM machine serves the dicer, vegetable washer, pea grader and washer, exhauster and filler.

The filled cans of vegetables pass on, as in the case of fruit, to an exhauster and sealer, Unlike the fruit, however, the vegetables do not then go to continuous cookers, but are placed in large cages for cooking in large steam retorts. These retorts are kept at a temperature of about 240 deg. F. at a pressure of about 12 lb. per sq. in., the cans remaining there for approximately a quarter of an hour. Over the retorts are exhaust fans to remove the steam and hot air. After they leave the retorts the cages containing cans are attached to an overhead conveyor and are taken outside the building to an 80-ft. long cooling trough through which they pass in about a quarter of an hour. The cages are then brought inside the building again for unloading, labelling and packing.

Vegetable soup is at present one of the company's most popular lines. For this a certain amount of diced vegetable is placed at

the bottom of the cans which are then carried on conveyors to the same machines as used for the fruit syruping. The remainder of the process is the same as for fruit. The liquid portion of the soup is made in a special room on the first floor, the ingredients being placed in 100-gal. tanks and then boiled by means of live steam. From the tanks the soup is pulped and sieved to remove all large lumps of vegetables, this being done in a cylindrical rotary machine incorporating a brush in the centre to push the vegetables through a wire-mesh sieve. The liquid is then gravity-fed into vats over the filling machines. Adjoining the soup room is another department where onions are prepared by a special machine driven by a 1-HP 1,425-RPM Laurence Scott motor.

For the labelling of the cans four machines each capable of handling 24,000 cans a day are installed. The cans are simply rolled down an incline, given a touch of adhesive to pick up a label and then another spot of adhesive to fix it. Each machine is driven by a separate motor. Though not yet in service another machine remains to be mentioned. This is a continuous lacquering machine for giving the cans additional protection against severe climatic conditions for dispatch abroad.

Apart from the canning the company also preserves a considerable quantity of fresh fruits and vegetables by means of its "frosted food" process whereby they are frozen very rapidly and kept in special cold cabinets right up to the time they are sold by the retailer. After thawing out they are practically indistinguishable from freshly gathered produce. A full description of the process was given in the ELECTRICAL REVIEW of July 21st, 1939, page 89.

In addition another section of the works produces about five or six tons of jam a day. Among the plant installed here is a continuous jar washer, rinser and dryer. Most of the plant installed in the cannery was supplied by American manufacturers and Cooper Bros., Wisbech, though several machines are of the company's own design and manufacture.

Science and Society

Necessity for Regional Planning

OPENING a three-day meeting organised by the British Association for the Advancement of Science last Friday, Sir Richard Gregory (President) delivered an introductory address on the theme of the conference, "Science and the World Order." Since its formation in 1931, the Association, Sir Richard said, had pursued its objects of giving a stronger impulse and more systematic direction to scientific inquiry, promoting intercourse among scientists, obtaining more general attention to the objects of science and removing obstacles to its progress.

National boundaries are an obstacle to the progress of scientific research and its useful application. In London last week scientists of all nations discussed means of securing international co-operation for the benefit of mankind

Science could produce peace and plenty or it could reduce the world to dust and ashes and its practitioners could no longer remain indifferent to the uses of the powers created by their researches. For this reason the Association, three years ago, formed a new Division for the Social and International Relations of Science, the main purpose of which was an objective study of the effects of the advances of science upon social conditions and to promote the welfare of human communities through international understanding of them. The object of the conference was to offer contributions to schemes of reconstruction designed to make scientific knowledge a blessing instead of a curse. Liberty to learn, freedom to express, and opportunity to develop were among the basic principles of service to science, as they were also essential to all creative growth.

In the Commonwealth of Science, there were no social, racial or geographical distinctions, and he welcomed the presence of many distinguished men who were exiles from their own countries as a result of a monstrous perversion of scientific ideals and expressed appreciation of the sympathetic support of scientists of the United States of America.

An address given by Sir Harold Hartley on Saturday dealt with "World Heat and Power Requirements and their Social Implications." Without the successive developments that had made heat and power available most of the scientific discoveries of the last 200 years could not, he believed, have made an effective contribution to civilisation. Milestones were Watt's improvement of the steam engine in 1769, Fulton's steamship in 1807, distribution of gas in 1807, Stephenson's "Rocket" in 1829, Faraday's discovery of electro-magnetic induction in 1831 (which culminated in the first electric power station fifty years later), the Swan-Edison lamp in 1879, Parsons' steam turbine in 1884 and the Wrights' first flight in 1903.

The main results of this progressive utilisa-

tion of energy were:—(1) Power-driven machines, with a continuous increase in productivity of labour and material resources, first in industry and later in agriculture; (2) rapid transport, making available world resources of raw materials and providing new markets; (3) development of metallurgical and chemical industries, producing secondary raw materials and fertilisers; (4) high-voltage distribution of electricity, making possible the dispersal of industry and thus avoiding overcrowding in urban areas. There was also the scientific application of heat and power in the home which provided some compensation for the social consequences of the mechanisation of industry in the nineteenth century.

Consideration of Needs

The immediate need was for a detailed quantitative consideration of the energy problems and possibilities involved in reconstruction. Considerable data were already available, particularly in the records of the World Power Conference.

From 1820 to 1900 the world annual consumption of coal showed a steady logarithmic increase from 20 to 778 million tons. By 1936, the world requirements of energy, apart from human and animal labour, had reached 1,400 million tons of coal, 240 million tons of oil, 400 million tons of wood, 50 million tons of natural gas and 130,000 million kWh of hydro-electricity.

Potential water resources (many very remote) had been estimated at from 15 to 30 per cent. of the total energy requirements, so that the burning of fuel must continue to supply the major part until other means of using the sun's radiation had been discovered. About 60 per cent. of the world coal production was ultimately utilised as heat and 40 per cent. as power. At the present rate of consumption coal reserves, including lignite, would last for an average of 4,000 years, those of Great Britain for 750 years and of the United States for 6,000 years. No estimate had been made of oil resources, but they were almost certainly much less extensive than coal.

Production and Distribution

Much of the improvement of conditions had resulted from the rapid development of virgin countries suitable for European immigrants and from rapidly increasing population—a phase that ended by 1900. The problem confronting scientists was to raise the world's productivity, particularly in backward countries and to secure the equitable distribution of products in relation to the needs of each country, thereby eliminating the waste of energy involved in the search for self-sufficiency within arbitrary geographical boundaries.

Regional planning would permit of joint use of heat and power by extracting steam from condensing turbines after partial expansion. Carbonisation of raw coal and the use of electricity in a co-ordinated scheme would help to solve the smoke problem in addition to providing cheap energy in the home.

Experience in Canada and the United States showed how much the tractor, motor vehicle and electricity could contribute to higher standards on the farm. At present about 88 per cent. (by value) of the world's agricultural production was used as food, 8 per cent. for textiles and 4 per cent. in other industries, the last two together representing roughly one-third of the raw materials of industry. Further development would depend largely on processing and on the factory becoming an adjunct to the farm. Over half of the 2,000 million inhabitants of the world were mainly engaged in agriculture in less developed countries. Transport, communications and the provision of power for driving machinery would open up new possibilities.

Longer-range problems for fundamental research included improvements in methods of utilising fuel; in the distribution and storage of electricity; in the uses of power; and in the production of oil from coal or vegetable products. The ultimate goal was the utilisation of the sun's radiation by some photo-chemical or photo-electric device to take the place of the solar energy stores in coal and oil.

Advice for Government

In a contribution entitled "The Use and Misuse of Science in Government," Prof. A. V. Hill, M.P. (Secretary, Royal Society), said that warmly as one might welcome a Conference of this kind, anxious as one might be to see all the resources of science, its results, its methods, and its habits of mind used in the service of the State, it was necessary to urge, and go on urging, that unless the independence and objectivity of science were upheld, more harm than good might result.

In many departments of Government there was need of scientific consultation, scientific foresight and scientific criticism. Permanent officials with a scientific education could meet part of the need, but the advice of outside scientists was necessary. The Scientific Advisory Committee and the Engineering Advisory Committee, both under the chairmanship of Lord Hankey, now fulfilled that function here. The arrangement was new but undoubtedly it worked well.

Among the other speakers were Mr. H. G. Wells, Dr. L. Guleck (Columbia University), Mr. H. P. Vowles, Dr. W. Penfield (Canada), Mr. D. P. Riley (Associate of Scientific Workers), Prof. J. Metadier (France), Dr. F. H. Boer, Prof. C. H. Desch, F.R.S., and Lord Samuel.

At the conclusion of the Conference on September 28th, Sir Richard Gregory announced that the Council had decided, instead of passing formal resolutions, to set up committees at once to deal with all the matters that had been under consideration.

PERSONAL and SOCIAL

News of Men and Women of the Industry

CHESTER Electricity Committee has recommended the appointment of **Mr. S. C. Harling**, A.M.I.E.E., distribution superintendent and acting deputy electrical engineer, Harrogate, as deputy city electrical engineer under Mr. S. E. Britton. There were eighty-five applications for the position, which has been rendered vacant by the resignation of Mr. C. A. Britton on his appointment as electrical engineer at Maidenhead.

Mr. T. A. Chell, A.M.I.E.E., has been appointed engineer and manager of the Isle of Thanet Electric Supply Co., Ltd., in succession to the late Mr. J. A. Forde. Mr. Chell joined the company in 1906 and has been chief assistant since 1919.

Mr. E. Mills, of the Ealing Corporation Electricity Department, and son of Mr. H. L. Mills, city electrical engineer of Stoke-on-Trent, was married recently at Trentham Parish Church, to Miss Kathleen Hammond.

Mr. Donald Burkewood Welbourn, assistant to the works superintendent of the English Electric Co., Ltd., and son of Mr. B. Welbourn, chief engineer of British Insulated Cables, Ltd., was married at Castle Church, Stafford, on September 20th, Dr. to Esther Hendry, of Aberdeen, former assistant schools medical officer, Birmingham.

Mr. J. Williams, who, as we reported in our last issue has been appointed assistant manager of the Cardiff Branch of the General Electric Co., Ltd., after ten years as manager of the company's Gloucester branch, was recently the guest of the Gloucester Circle of E.D.A. at a farewell supper held at Urch's Café. During the evening Mr. Williams was presented with an inscribed silver entrée dish and soup bowl. The gathering was presided over by Mr. F. H. Corson, the city electrical engineer, who is chairman of the Gloucester Circle.

Mr. W. A. F. Owen has been appointed to succeed Mr. L. Owen (whose retirement we recently reported) as mains superintendent in the Charing Cross & City district of Central London Electricity, Ltd.

T.M.C.-Harwell (Sales), Ltd., tell us that of their sales representatives, **Mr. S. M. Harris** (sales manager) is now acting flying officer in the R.A.F. Intelligence Corps; **Mr. J. A. Kendle** is acting pilot officer in the R.A.F., Ground Defence, and **Mr. P. J. Grose** is serving with the Royal Artillery (Signal Section). These are in addition to other members of their staff who joined H.M. Forces earlier in the war.

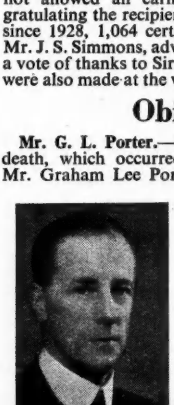
Miss Madeleine Marie Nobbs is the first lady to qualify by examination for associate membership of the Institution of Heating and Ventilating Engineers, of which her father, the well-known consultant, is a past president and acting hon. treasurer.

Mr. W. H. Radley, overhead lines superintendent with the Portsmouth Passenger Transport Department, has retired after forty years' service with the Portsmouth undertaking.

At Milton Court on September 19th, **Sir Montague Hughman** presented long-service certificates to twenty members of the head office staff of W. T. Henley's Telegraph Works Co., Ltd. Mr. A. H. M. Jacob, secretary of the company, explained that the presentation concerned individuals who had completed twenty years' service on October 31st last year, but circumstances had not allowed an earlier presentation. In congratulating the recipients, Sir Montague said that since 1928, 1,064 certificates had been awarded. Mr. J. S. Simmons, advertising manager, proposed a vote of thanks to Sir Montague. Presentations were also made at the works in August.

Obituary

Mr. G. L. Porter.—We regret to learn of the death, which occurred on September 22nd, of Mr. Graham Lee Porter, one of the senior engineers of Ferranti, Ltd. Mr. Porter was born in Ceylon in 1883, and was the son of a tea planter. He was educated in Edinburgh at George Watson's and the Heriot-Watt Colleges. His first post was in the electrical department of the North-Eastern Railway Co., which he left to take up an appointment with the Newcastle - upon - Tyne Electric Supply Co., with whose interests he continued to be concerned when he later joined the staff of Merz & McLellan, consulting engineers. He joined Ferranti, Ltd. in 1927. Mr. Porter was a member of the I.E.E. and served as chairman of the North-Western section for 1936-37.



The late Mr. G. L. Porter

Mr. Jack Hills.—We regret to learn of the death of Mr. J. L. Hills at Minehead on September 23rd. Mr. Hills was the senior London representative of Callender's Cable & Construction Co., Ltd., with thirty-eight years' service at the Frith works, in the provinces, and latterly in London. He was prominently associated with the company's many social activities and was first general sports secretary in 1906.

He played on many occasions for the Kent 2nd eleven and also in leading London club cricket, covering a period of over thirty years. He was equally well known in the football world, being the amateur captain of Clapton Orient for nearly ten years. He also played seven seasons for Ilford. He was 62 years of age.

Mr. Victor Lever, B.Sc., works chemist and relief charge engineer at the Oldham Corporation power station, was badly burned and has died as the result of a switchroom mishap. At a meeting of the Electricity Committee it was decided to send a message of sympathy to the family. Mr. Lever had tendered his resignation as he had been appointed station superintendent at Harrogate.

Mr. M. Deacon.—The death occurred on September 25th of Mr. Maurice Deacon, J.P., F.G.S., M.Inst.C.E., M.I.E.E.

Chile's Electrical Needs

Home Production and Import Trade

By a South American Correspondent

Our contributor sets out the position in the Chilean electrical import market, noting the shares of the United States, Great Britain and Germany, and advises on trading methods

THE development of Chile as of most of the other South American countries with which I have dealt has been due primarily to the pioneer work of British capitalists and engineers; the total amount of British capital invested in Chile is estimated at some £83,000,000 sterling. However, for some years before the present war Germany was able to penetrate deeply into the import markets of Chile through the operation of the "Aski" mark in "compensation" trading. Between the years 1932 and 1938, the proportion of Chile's total imports represented by German goods rose from 15 per cent. to 26 per cent., whereas, over the same period, Chile's imports of British goods fell from 13 per cent. to 9½ per cent.

The population of Chile is estimated at about 5,000,000 and they are among the most energetic and go-ahead people in Latin America. The Republic has an area of 285,100 square miles and, while the average width of the country is only about 80 miles, the Pacific coast line is 2,800 miles long. On the east, Chile is bounded by the tremendous mountain wall of the Andes. Owing to the length from north to south, there is every variety of soil and climate. In the north is a region of desert, which, however, produces nitrate of soda, one of the most valuable fertilisers in existence.

Mineral Wealth

The central zone contains very fertile valleys and is the heart of Chile, including the principal cities of Santiago, Valparaiso and Concepcion, which are modern and imposing; factories have sprung up in many places. Farther south comes the farming area, from Concepcion to Puerto Montt, and farther south still, the cold and stormy region containing much virgin forest and given over principally to sheep farming. Agriculture is an important industry, as also are fishing and forestry, but the chief wealth is derived from mineral deposits, especially copper and nitrate of soda.

Chile is the chief mining country in South America and provides about two-thirds by value of the whole Continental output of minerals and metals, thereby adumbrating a continued demand for mining equipment, including electrical machinery.

After the Great War of 1914-18, nitrate of soda ceased to be Chile's main source of wealth, on account of the growth in the main consuming markets of synthetic nitrates. Copper is now Chile's chief export, the value in 1940 having been 380,838,000 pesos of 6d. gold (or more than 50 per cent. of the total exports of 696,727,900 pesos).

Exports of nitrate in 1940 were worth 128,161,000 pesos, followed by iron ore and other metallic minerals, excluding copper, worth 50,811,700 pesos, whilst other important exports were cereals, fruit, wool, gold bars and iodine. Chile is one of the few South American sources of coal, and, although this is of the soft variety, it is of good quality and has a high content of volatiles. It is thought that, sooner or later, it will be turned to good account by a low-temperature distillation process.

Trade statistics are expressed in pesos of 6d. gold (*i.e.*, 40 pesos per £ gold). There was a severe slump in Chile's export trade following the crisis of 1932, which resulted in a lowering of purchasing power for imports as well as the introduction of severe foreign exchange restrictions. However, total exports in 1940 rose to 696,727,900 pesos from 682,857,600 pesos in the pre-war year of 1938, whilst imports cost 507,110,400 pesos against 498,956,900 pesos. On the basis of official figures, therefore, Chile has registered a favourable balance of trade for some years past. Actually, however, it is doubtful if the real balance of trade is favourable to Chile, inasmuch as the two principal exports—copper and nitrate of soda—are subject to certain regulations which preclude the whole of the corresponding exchange proceeds becoming available to pay for imports.

United States Predominance

Moreover, the recent increase in exports has mainly been due to the armament demand in the United States for copper, nitrate, etc., and, as the resulting dollars may not be arbitraged into sterling, there still continues a shortage of sterling exchange to pay for imports from Britain and the rest of the sterling area. Such stringency can only be relieved by further British purchases of agricultural products. Actually, imports from the United States represented 47.9 per cent. of Chile's

total imports in 1910, against 27.8 per cent. in 1938; those from Britain 10.4 against 10.6 per cent.; but those from Germany slumped to only 3.5 from 25.3 per cent.

Factory output in Chile has increased enormously during the past ten years. The general index of industrial production in 1939 had reached 151 (basis 1927-29=100), and advanced during 1940 to 167, and in April, 1941, to 180. National industries are fostered by a protective policy, and are concerned chiefly with the production of low-priced goods, for which there is a brisk inquiry. There are nearly 6,000 manufacturing establishments in Chile, employing about 300,000 people. Progress is due, to a great extent, to the readily available supply of motive power for machinery, especially electrical energy, and no fewer than 3,000 factories use electricity in the region of which Santiago and Valparaiso are the chief centres.

The electrical services of the country are under the direct control of a State Department, there being some 200 companies distributed among 238 cities. The rapid development of air services has resulted in the establishment of aircraft factories; the cement output is some 600,000 tons annually; the chemical industry turns out raw materials as well as finished goods; and railway trucks are now built on a large scale for the national railways. Iron and steel products are also produced locally, and there is a national iron-smelting establishment at Valdivia. Among latest developments is a proposal to construct a hydro-electric plant in the Province of Valdivia, utilising the falls of the Huilo-Huilo, the cost being estimated at 200 million pesos.

The Power Position

Among the manufacturing industries, energy and fuel show the largest increases. The production of coke rose from 85,032 tons in 1939 to 96,500 tons in 1940; production of gas was 86 million cubic metres in 1939 and 93¾ million cubic metres in 1940; electricity production was 509,353,312 kWh in 1939 and 569,806,473 kWh in 1940. Coal owners have found difficulty in increasing production to keep pace with the demand, due to Communist agitation at the mines. Rationing among the major consuming industries and railways has been in force for some considerable time, despite importation. The shortage of coal is having a serious effect on the production of gas, which is now insufficient to meet domestic demand; transport is also being hampered owing to the restriction of train services. Such matters tend to slow down the wheels of industrial production; nevertheless, the index shows an improvement. To keep pace with this increase in industry and the constantly rising costs of labour and raw materials, the major producers have all substantially increased their capital during the past two years.

This increased industrialisation naturally affects the various lines of imported goods, such as an increase in heavy electrical equipment and a contraction in the smaller electrical products—excluding wireless material—now being produced by local factories. This is borne out by the following details of imports of electrical items in the year 1940 (which totalled in value 14,188,200 pesos) compared with those in 1936 when imports totalled 11,609,600 pesos :—Wireless material, 4,560,000 pesos in 1940 (against 2,119,000 pesos in 1936); wires and cables, 3,075,000 pesos (2,860,000 pesos); motors, dynamos and other electrical machinery, 2,105,000 pesos (1,795,000); telephone and telegraph materials, 1,570,000 pesos (2,031,000); electric light bulbs, 1,161,000 pesos (1,308,000); electric meters, 509,000 pesos (431,000); electric lighting material, 463,000 pesos (540,000).

Sources of Imports

Statistics of Chile's imports of electrical materials by countries of origin have not been published since 1938. As, however, that year witnessed the zenith of Germany's competition in the Chilean market, the following statistics of imports from the chief supplying countries illustrate the extent to which German goods can be replaced by British:—

Class	United States	Germany	Great Britain
	(Thousands of pesos)		
Meters and transformers	1,546	1,432	158
Wires and cables ..	1,033	572	326
Electric lamps ..	509	775	13
Telephone apparatus	191	21	1,150
Radio receivers and parts	2,082	539	13
Carbons and electrodes	366	131	12

Adequate representation by good agents or other means is of paramount importance, and the remarks regarding methods of obtaining business connections in various South American countries dealt with in recent issues of the ELECTRICAL REVIEW apply equally to Chile. So also does the information regarding sources of advice, including the trade's export group, the Department of Overseas Trade, banks and chambers of commerce, including the British Chamber of Commerce in Valparaiso, which has branches at other points in the Republic. As in all South American markets, prices must be extremely competitive, whilst catalogues, etc., must be drawn up in Spanish, and the metric system employed in quotations and estimates.

The most agreeable time for visiting Chile, where, generally speaking, there are no fixed buying seasons, is from October to March. Santiago, the capital, and Valparaiso, the chief port, are the largest business centres,

although there are important markets along the extensive coast line from the nitrate and mining districts in the North to the sheep-farming areas in the South.

The unit of currency is the *peso*, which is divided into 100 *centavos*. Exchange control has been in force since 1931, and certain imports are subject to quota. A system of controlling imports by means of prior permits is also in force at Santiago and Valparaiso, and the exporter on this side should take the precaution of ascertaining that a permit has been obtained before shipping goods to those two centres. The permit is normally valid for three months for imports from Europe, but an extension can be obtained should unforeseen delay in shipment occur.

A prior permit is no guarantee that exchange will be provided, since a separate exchange permit must be applied for when the goods arrive and before they can be cleared from the Customs; even an exchange permit merely gives authority for cover to be bought as and when obtainable. The rate of exchange applied to ordinary imports is the "export" rate of 101.35 pesos per £, but, owing to the frequent shortage of sterling in the "export" market, increasing use is being made by importers—with the assent of the exchange control authorities—of the "whitewashed" market, where the rate is 125.70 pesos per £. Both these rates apply to remittances through Special Account under the British Payments Agreement with Chile, and some imports are authorised partly at one rate and partly at the other.

Under the Export of Goods (Control) (No. 6) Order made by the British Board of Trade on February 19th, 1941, an export licence is required for all goods shipped to Chile. It is understood that the British Government by this means intended to limit the f.o.b. value of exports from the sterling area to Chile in the first eight months of 1941 to £600,000. This decision meant a severe contraction in trade between the two countries, and it is understood that the Board of Trade is still not issuing licences freely. However, the prospects in this respect depend largely upon future purchases of Chilean products by the British Government.

A large proportion of trade with Chile is conducted by means of documentary bills sent through a bank for collection, although Chilean importers frequently open letters of credit which permit payment to be obtained against documents in London. Shipments to Chile are invariably on "cash against documents" terms; in fact, it is inadvisable to draw bills at usance because the Chilean monetary law allows the importer to discharge his obligation by depositing pesos for an equivalent amount calculated at the "official" rate of exchange (77.96 pesos per £) should the necessary foreign exchange not be procurable. Such deposits would then have to be converted into sterling, as and when possible, at the higher "export" rate.

It is possible, however, for the British exporter to overcome this difficulty of granting credit terms by arranging with the collecting bank to discount bills at, say 90 days' sight, drawn in local currency and accepted by the Chilean importer, who utilises the proceeds to liquidate the sterling bills, as soon as cover is available. Such facilities are purely a private arrangement between the exporter and the bank, and the exporter would be required to guarantee payment of the bills in local currency accepted by the importer.

The Grand Coulee Plant

First 108,000-kW Set Started Up

AFTER final tests the first of three 108,000-kW Westinghouse generators, each driven by a 150,000-HP water-wheel, is being started up at the Grand Coulee Dam. Each generator is stated to be nearly one-third more powerful than any hydro-electric generator previously built in the United States. The machine will be placed in service as engineers open valves and permit the waters of the Columbia River, impounded behind the great dam, to operate the turbine. The second machine is expected to go into operation about December 1st and the third in March, 1942. Energy from the Grand Coulee West power house will be transmitted over a 230-kV line to Bonneville Dam, on the lower Columbia, where it will be made available for use in a new aluminium-manufacturing plant at Vancouver, Washington. To carry the energy to defence industries in the Pacific Northwest, the Bonneville Power Administration is erecting a 230-kV transmission line to Covington, near Seattle, where power will be made available for use in expanding Puget Sound shipyards and other defence industries. Work is soon to be undertaken on a second line to Bonneville. By next January 1st two 115-kV lines will have been built to the Spokane area, to serve plants manufacturing non-ferrous metals.

When completed, the generating plant at Grand Coulee Dam will be the largest single source of power in the world and will comprise 18 main generators, all of the 108,000-kW size. Some of the energy will be used eventually to pump water into the semi-arid Big Bend area from 50–125 miles south-west of the dam.

Each generator is 24 ft. high and 45 ft. in diameter. The spider is a single piece of steel weighing 50 tons used to support the rotating mechanism on the shaft; the 74-ft. shaft itself weighs 135 tons, and comprises three parts bolted together.

Among materials used are 750 tons of steel, 77 tons of copper, 116 tons of laminations for the stator, 214 tons of laminations for the rotor, 96 tons of steel castings, 9 tons of cast-iron, 3,500 lb. of alloys, 3,000 lb. of brass, 165,000 sq. ft. of mica insulation, and 355,000 ft. of insulation tape.

Rubber Process Control

Scope for High-grade Electrical Instruments

By P. Morris

MANUFACTURERS of rubber are large users of electrical instruments, and with the widening uses of rubber in industry, there is an increasing demand for indicators, recorders and controllers of a very high degree of precision.

Considerable development has taken place in cycle controllers since the period represented by the popularity of the pot heater, which started about 1925, but the beginning of real development work followed the advent of watchcase moulds in 1927. Cycle controllers in pot heaters were originally used to regulate the relation between time and temperature in the heater during a step cure. To this function was added the control of admission of air-bag pressure and external cooling. Their use was to eliminate as far as possible the vagaries of the steam tender.

It became evident that the inherent operating efficiency with watchcase moulds could not be attained unless some form of automatic operation was adopted. The progressive movement of the tyre layer who placed the unvulcanised tyre in successive moulds required that the vulcanising operation should proceed in the correct manner without his supervision.

Cam-Actuated Valves

The early forms of cycle controllers were relatively simple; some were large enough to control directly, through cam-actuated valves, the time of admission of the various services supplied to the mould. The actual opening and closing of the mould was accomplished manually. These controllers were generally of the single-cam type in which the operations at the beginning and end of the cure were in reverse sequence. Small air-pilot valves or switches were also used for remotely operating valves which directly controlled the flow of the services. When the cures became more complex, with shorter loading interval and cure time, it became difficult to set the time of the various operations accurately, and the valve sequence lacked flexibility. The disc is about 3 in. in diameter, and in a 100-min. cure, 1 min. is equal to 0.1 in. Possible accumulated error could easily upset the cycle of a group of moulds.

To provide flexibility in valve sequence, the multicam cycle controller was produced, but the difficulty of time setting remained. The small cam was still used for both time measurement and valve operation. To-day time measurement and valve operation are generally handled separately.

In a typical modern example an impulse timer is connected to a sequence controller (often in the same case) by an eight-conductor cable. The dual arrangement permits placing the pilot valves in the sequence controller in proximity to the diaphragm valves and so reduces the amount of copper tubing used in the control lines. The impulse timer consists of a disc driven by a synchronous motor, with perforations on its periphery for trip pins, the position of which determines the time of operation of the sequence controller. These discs can be so driven that the permissible maximum time of control is in steps—for example, 10, 20, 40, 80, 160, and 320 minutes. This unit can be made with push-button release and spring return or hand reset.

After an impulse has been received by the sequence controller from the first instrument, the cam shaft moves forward through a pre-set portion of its cycle, operating one or more pilot valves. The sequence controller then stops at a pre-set index point until the next impulse is received. This progression is continued until the cure is completed, when the sequence controller is automatically re-set. Short operational times can be obtained by permitting the cam shaft to pass through any of the indexed positions without stopping. The speed of the cam shaft is adjustable in ranges of 0.5 to 10 RPM and high speed and torque is available for valve operation. The construction of the cams is such that cure changes can be made quickly without fine adjustments.

Thus, with a relatively high-speed camshaft, individually adjustable cams for the pilot valves, and an accurate timing device for the longer intervals of cure, flexibility and accuracy result.

Temperature Controller

In equipment producing the smaller size tyres, the cost of the instruments is a higher proportion of the total cost than with equipment handling large tyres.

A modification of an instrument developed to work with the cycle controller has been on the market for many years. This is the temperature controller. Using a tyre pressure gauge as an operator, the controller can be remotely actuated between two pre-set positions. This means that a pilot valve in the sequence controller can be used to obtain a pre-set step cure. It is an example of how a simple control can be cheaply converted to accomplish more than was intended in the original design. Other arrangements of these small gauges can give a greater combination of pre-set temperature or pressure-control points.

The use of thermocouples in heat transfer analysis is relatively old in the industry, but in recent years instruments have been developed to expedite such analysis. For example, a combination of a photo-electric potentiometer with a strip-type recorder enables the investigator to follow and record rapid changes in temperature. In large size tyres (30 in. section, 40 in. rim diameter, 34 plies) a complete analysis of heat transfer would be a laborious affair if it were done manually. The time involved in the cure is over eight hours. Such an analysis has been made involving forty-eight points. At the beginning of the cure, and at certain times during the cure when radical changes in temperature occur, the valves of all the points have to be read as rapidly as possible. By placing successive cycles of the record in a vertical arrangement, the temperature gradients and changes with time can be easily visualised.

Checking Oven Performance

An example of the use of a high-speed recorder is that in which a couple is permitted to pass through a continuous drying oven with the material. The record obtained will often show errors in baffling, poor air circulation, and location of heaters. Such errors often cause variations in temperatures of the material even in the best ovens.

The temperature of stock in tread tubers is no longer a matter of guesswork. In one method a thermocouple is mounted in the head about 3 in. from the dies. Experience has shown that the tip of the couple should be on the geometrical centre of the throat at the place of insertion. Checks with a compensated thermocouple needle show close relationship with the recorded temperature. The distance (3 in.) of the couple from the dies is checked to prevent a permanent line of cleavage in the extruded stock.

At one time attempts were made to use vapour-pressure recorders in a Banbury mixer and the errors which occurred were sometimes as high as 60 deg. F. Such methods have been superseded by the heat-insulated thermocouples in rugged mountings located with a view to accessibility for maintenance. It is more economical to have all potentiometers of the recording type reading in millivolts. Both these instruments have increased processing capacity and uniformity of product.

Rotary Thermocouple

Temperature of stock in motion, such as on calender rolls, still provides a problem. Some success has been obtained with a rotary thermocouple, the roller having a composite rim of two thermoelectric materials. For press temperature analysis, one test plate assembly has five couples on each side and, when placed in a press, will permit a rapid survey of temperature under curing conditions.

Within the past few years X-rays in diffraction work have become important in the development of synthetics, but a simpler and more direct use is that of product inspection, units having been made for the inspection of tyres in the field. The use of guards is necessary, substantiated by analysis of the stray X-ray emanations present without them. The unit is fitted with a fluorescent screen, viewed from the inspection point. Fabric breaks, foreign materials, and, in some cases, separations can be determined in this way. Such a unit can be adapted to obtain the desired information without needless expense or destruction of the article, such as whether a tyre is worth retreading.

In portable designs each wheel must be raised for inspection of the tyre. In the larger service stations a more comprehensive unit can be installed. A single X-ray head and screen (incorporated in the brake testing equipment) can be moved round the drive-on unit for inspection.

Plastometers have operating characteristics approaching that of the processing machines on which they are run. A ¼-in. slab of rubber stock is preheated for 6 minutes in a platen press at 185 deg. C. It is then placed in the plastometer between dies which are closed through a toggle linkage by air pressure on a cylinder. A definite volume of the stock is thereby trapped in the die space where it is allowed to stay for 20 seconds. The dies are electrically heated, and the temperature is controlled through a pyrometer in connection with a couple in each die.

Sixty Tests per Hour

After the 20-second interval, a plunger automatically descends under the action of controlled air pressure on a diaphragm of the die assembly. This forces through an orifice 0.110 in. diameter an amount of stock equal to the volume displaced by the plunger. The range of air pressure is from 4 to 20 lb. per sq. in. The time of extrusion over the middle 90 per cent. of the stroke is measured and indicated on a timer in seconds. This type of plastometer can take its place in the routine millroom control test procedure without becoming a bottleneck, since as many as sixty tests per hour can be made. Using a pneumatic delivery system to and from the mills, a complete check can be made on plasticity in a total elapsed time of 10 min.

For the laboratory a somewhat simpler model has been developed which has fundamentally the same characteristics. It requires manual power to close the dies and does not use a preheater press. The sample is heated for 15 minutes in the dies, and the plunger stroke is initiated manually. The use of these plastometers has proved worth while in the control of stocks in milling Banbury operations and crude-rubber checking. If necessary, stocks on mills can be checked before "batching off" and without appreciable interruptions in process flow through the plant.

COMMERCE and INDUSTRY

X-Rays in Industry. Training Women Engineers.

Reservation of Appliance Repairers

AMONG the latest changes in the Schedule of Reserved Occupations and Protected Work is the alteration of the "reserved" age for domestic appliance repairers (not strippers) in electrical undertakings at Stage C to 35. Formerly the age was 23 for protected establishments and 35 for men in other employment, this grade being included in the general heading "Other workers (fitter, erector, etc., electrical engineering.") In announcing this alteration the Minister of Labour and National Service says that hitherto domestic appliance repairers employed by electrical undertakings have been reserved as if they were highly-skilled electrical engineers. This treatment was not, in fact, justified, and the age of reservation became 35 on October 1st. It is stated that only about 120 men of military age are affected.

Torch Battery Prices

The Electric Torch Dry Batteries (Maximum Prices) Order, which came into operation on September 22nd, provides that a manufacturer, importer or wholesaler shall deliver with supplies or before, a notice to his customer setting out the appropriate maximum price of the goods.

Description of battery.	Class A.	Class B.	Class C.		
	Maximum retail selling price each	Maximum retail selling price each	Maximum wholesale buying price per dozen	Maximum wholesale selling price per dozen	Maximum retail selling price each
	d.	d.	s. d.	s. d.	d.
Bijou or No. 216 Large Unit Cell, Large Mono or No. 2 ..	8½	6¼	2 6	3 1	5¼
Medium or Baby, Small Mono or No. 1 Unicel ..	6¼	5½	2 7½	3 3	5½
Fountain Pen or Penlite Single Cell or No. 9 Unicel	6¼	5	1 7¼	2 0	3½
Fountain Pen or Penlite 2-cell ..	5	3¾	1 2	1 5½	2½
	10	7¼	2 4	2 11	5

Retailers are required to exhibit a list of maximum prices of the torches which they sell.

The new prices fall under three headings :—Class A.—Batteries imported from the United States; Class B.—Batteries sold under the brand name "Burgess" or which have come from Canada; and Class C.—Batteries imported from other countries. The prices which are set out above include Purchase Tax.

Cooker Control Boards

The third edition of BS.438 is about to be issued. The primary object in redrafting it was to provide for a fuse to serve an additional point in accordance with Clause 201 (B) (ii) of the eleventh edition of the I.E.E. Wiring Regulations. When the revision was commenced before the outbreak of war such a special fuse had been provided for in some designs of cooker control gear, but in a manner contrary to the present requirements. Until redesign becomes possible strict compliance with the fresh stipulations will not be insisted upon (for the duration of the war) in respect of protection of the auxiliary circuit, provided that in all other respects the new specification is complied with. Several modifications of a minor nature have been made and alternative arrangements are also allowed for. Copies of the new document will be obtainable from the British Standards Institution, 28, Victoria Street, London, S.W.1., price 2s. 3d., post free.

Industrial Radiology

A correspondent writes: The Industrial Radiology Group of the Institute of Physics held a Conference on September 24th at the Royal Institution, Albemarle Street, London, W. This may be said to be the first fully-fledged meeting of the new Group, and a large number of engineers, metallurgists and others were present. The conference, which was presided over by Prof. J. A. Crowther, was opened by Sir William Bragg, O.M., who congratulated the Institute and those concerned on inaugurating a section of the Institute dealing with radio-metallurgy and radio-metallography, two branches of X-ray work likely to prove of vast importance to national industry.

Unfortunately the proceedings were considered as being of a confidential nature, and Prof. Crowther said that no publication of any part of them was permissible. In view of the large number of papers both excellent and detailed which have recently appeared in the *Journal of Scientific Instruments*, it is difficult to understand this attitude, more so in view of Sir William's emphasis on the advantages that were invariably derived from free intercourse on scientific matters.

Dr. Betteride (Bristol Aeroplane Co.) read a general paper on the application of X-rays to industrial problems; Mr. Gillespie (Babcock & Wilcox, Ltd.) described the examination of welds; while Mr. P. M. Bailey (High Duty Alloys, Ltd.) discussed the application of X-rays to the examination of magnesium alloy castings.

A Bogus Radio Institution

At Salford Police Court, on September 24th, Richard William Nunns Spencer (47), Broughton, was sentenced to 12 months' imprisonment for obtaining money by false pretences from persons who sought membership of the Royal Institution of Radio Engineers, which was alleged to be a bogus business run entirely by Spencer for his own

benefit. It was stated that he bought the business in 1939 for £300, and according to the accounts it showed a profit of £2,000 a year. The following "diplomas" were issued: "A.M.I.R.E.", £3 3s.; "M.I.R.E.", £5 5s.; and "Fel.I.R.E.", £10. There was no examination before the "diplomas" were issued and no lectures; no application for membership had been refused. In 1939 there were 400 live members, now there were over 1,800.

The defence was that there was no legal bar against a man deciding to set up an institution and taking all profits himself. If there were any false pretences, such persons knew about them all the time, but all they wanted was letters after their names.

The stipendiary magistrate said he was satisfied that the institution was a ramp, which merely existed for the purpose of selling letters to people to affix after their names.

Women in Engineering

"The registration of women and the demands that are being made on them from every department of national service will make this a period of greatest interest in the history of women." This statement was made by Miss Caroline Haslett in her presidential address to the Women's Engineering Society, given at the Institution of Electrical Engineers last Saturday.

Certain outstanding differences existed in regard to the work of women in the last war and this. Women brought to the war effort a new attitude and, whereas in 1915 men, for the most part, were incredulous, in 1939 they were, some of them, antagonistic to the entry of women into their special field. Since the fall of France there had not been so urgent drain of manpower into the armed forces, and the reservation of employment had provided employers with the means of deferring the recruitment of women.

There remained over from the last war a nucleus of women, trained in engineering, whose numbers had been increased year by year by young women anxious to train as engineers. Furthermore the introduction of so much machinery, the development of mass production, and the growth of engineering production invited the employment of women for repetition work. Now there was a Ministry of Labour, non-existent in 1914, prepared to undertake the training of women on the lines indicated in the Great War.

There was a developing demand for women in electrical engineering and more recently in electricity supply undertakings where they already performed, or would do so shortly, the duties of maintenance engineers, meter testers, fitter's mates, plumber's and joiner's mates, mains records clerks, and substation assistants.

Young Women in Retail Trade

The Minister of Labour and National Service announces that with a view to increasing the supply of women for recruitment to the women's auxiliary services and other vital war work, he has decided, through the machinery of the Registration for Employment Order, to withdraw from the retail trade, other than food, all women aged 20-25 inclusive. The businesses affected will be those wholly or mainly engaged in retail distribution other than food.

Where the employer can show that the woman is a key worker and that time will be necessary to train a substitute, a reasonable period before withdrawal will be given, but it is considered that these cases should be exceptional. Employers will be consulted beforehand in respect of each worker, and women in the age groups 20-25 who are running their own businesses will have an opportunity under the general procedure for consideration of personal hardship, of appearing before a Women's Panel of the Local Employment Committee.

Employment Exchanges will have discretion to regulate withdrawals to a timetable agreed with particular employers where an appreciable number of women are involved and due inconvenience might therefore result.

Factory Black-out Installations

Referring to the article on a "Multi-motor Black-out Installation" in our issue of July 11th, the London Electric Firm, Croydon, states that their precision worm winches were used, the drums having a divided barrel in which one section of rope winds on, while the other section pays out, thus giving a traversing movement to the shutters.

G.E.C. Displays

When the General Electric Co., Ltd., introduced "Osram" luminescent showcards on the ceilings of coaches on the Piccadilly railway in February,

A topical display in one of the windows of the G.E.C. at Magnet House, Kingsway, W.C.2, in support of the London Salvage Campaign

it was done more as an experiment than anything else. The idea, however, has proved so successful that the scheme is to be extended to cover practically the whole of the suitable routes of London's "Underground." Soon advertisements will be appearing on the roofs of the coaches, the lighting in which will provide the necessary excitation of the luminescent message. This form of display is only

one of the luminescent media which the G.E.C. has used in Osram lamp campaigns. As far back as December, 1939, sites on most of the important railway stations were acquired for displaying an effective glowing advertisement. This consisted of a poster shown in the accompanying illustration, about 80 in. by 60 in. carried out in fluorescent materials. These advertisements continue to glow only so long as they are irradiated by the invisible rays from some ultra-violet light source. The source of excitation used in this scheme is the Osira "black glass" lamp. This method of night advertisement is being continued on a large scale as a complementary scheme to the more orthodox "Osram" publicity campaign.

Educational Films

The success of the first food and nutrition film ("Miss T"), made by the Electrical Association for Women, suggested a sequel, and the importance of vegetables in the nation's diet indicated the title of "Mrs. T. and her Cabbage Patch." The film, the première of which took place on Tuesday, is a G.B.I. production, directed and produced by Miss Mary Field, with the co-operation of the Board of Education and the approval of the Ministry of Food. "Mrs. T." takes herbs from her window box and cabbages from her allotment to the communal restaurant where all kinds of people are fed—grown-ups, school children, toddlers and babies. The layout and equipment of the canteen kitchen, the methods of preparing and serving the food, especially home-grown vegetables, will give valuable hints to all canteen workers and housewives. Miss Katharine Page, daughter of Sir Archibald Page, chairman of the Central Electricity Board, again plays the part of "Miss T."

The National Joint Committee for Scientific, Technical and Engineering Supervisory Staffs is giving an exhibition of technical films at the Portland Hall, Little Tichfield Street, off Gt. Portland Street, London, on October 11th at 3 p.m. The exhibition will give the latest information on the present position of the worker in science, technology and engineering. Tickets (6d. each) can be obtained from the Committee at 30, Bedford Row, W.C.1.

Wages in the Cable Making Industry

The Joint Industrial Council for the Electrical Cable Making Industry announces that the cost-of-living figure on September 1st (99 per cent. above the 1914 level) will not involve any alteration in wages on the third pay-day in the present month.

Fatality

An open verdict was recorded by the Reading coroner at an inquest held last week on John George Morris, a scaffolder, who received a fatal electric shock when a steel pole he was holding came in contact with an overhead line. Mr. H. D. Berry, assistant mains engineer to Reading Corporation, said that the Corporation was in the course of transferring the lines underground, but had been awaiting the necessary official permission to purchase the cables which were required.

He had visited the housing estate the day before the accident and found that the builders had proceeded further under the lines than he had advised. He noticed that the clearance between the lines and the roof of the house on which Morris was working at the time of the accident was not safe and he suggested roping the buildings off.

Trade Announcement

Simmonds Aerocessories, Ltd., announce that the range of nuts and fastenings hitherto sold by them under the title of "speed nuts" will in future be known as "spear nuts."

Multicore Solders, Ltd., Bush House, London, W.C.2, announces that it is now able to supply its "Ersin" multicore solder wire in pure tin.

TRADE MARK APPLICATIONS

APPLICATION has been made for the registration of the following trade marks. Objections to any of them may be made within one month of September 24th:—

PHILIPHONE. No. 579,128, Class 8. Electrical apparatus and instruments for recording, reproducing, producing and amplifying sound, and component parts of these.—Philips Lamps, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

DESIGN ONLY.—No. 614,390, Class 9. Wireless receivers, television apparatus, talking machines, telephone apparatus and component parts.—Kolster-Brandes, Ltd., Cray Works, Sidcup. (To be associated with No. 502,314, Class 8.)

ELLISON. No. 615,059, Class 9. Electric switches.—George Ellison, Ltd. Wellhead Lane Works, Perry Barr, Birmingham, 22.

TECHNOTHERM. No. 615,527, Class 9. Electric welding apparatus and electrodes.—O. C. Hartridge, 113, Victoria Street, St. Albans.

LENTI-LITE. No. 615,276, Class 11. Lighting fittings made of glass.—Holophane, Ltd., Holophane House, Elverton Street, Vincent Square, London, S.W.1.

CONCORD. No. 613,791, Class 17. Electric insulators, electrical insulating material, india-rubber cord, indiarubber thread, mica, rubber tubing and asbestos wire.—Concordia Electric Wire Co., Ltd., Trent Mills, Derwent Street, New Sawley, Long Eaton, nr. Nottingham. (To be associated with No. 613,789, Class 6, and another.)

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

P.H. convectors (made by Greene, Phillips & Co.) present suppliers or address of makers.

H. V. Marmorek (late 329, High Holborn) present address.

ELECTRICITY SUPPLY

St. Pancras Accounts. London Shelter Improvements

Aldershot.—SHELTER LIGHTING.—The Borough Council is to have electric lighting installed in underground shelters at Princess Gardens, the Municipal Gardens and High Street recreation ground.

Birkenhead.—PRICE INCREASE DEFERRED.—The Electricity Committee proposed to increase the tariffs but has been asked by the Electricity Commissioners to defer making the changes until the end of the present financial year (March 31st). It had been intended to make the increases operative from the June quarter meter readings.

Glendale (Northumberland).—NO SUPPLY FOR MILLFIELD.—The Rural Council's application to the North-Eastern Electric Supply Co., Ltd., for a supply of electricity for the village of Millfield has been rejected for the time being. The company states that only work of national importance can be carried out at present, but further consideration will be given to the matter after the war.

Ilford.—SHELTER HEATING.—The Corporation Emergency Committee has authorised the borough engineer and the electrical engineer to install " black heat " units in public, shop, basement and trench shelters.

Kingston-upon-Thames.—REVISION OF CHARGES.—It has been recommended by the Electricity Committee that the tariff for large heating installations thermostatically controlled shall be increased from ¼d. to ½d. per kWh during the night and from ¾d. to 1d. per kWh during the day, the increase to come into operation on the first convenient date after approval by the Electricity Commissioners. The Committee has also recommended that, dating from October 1st, the charge for electricity supplied to Corporation buildings shall be adjusted in accordance with the rise and fall of coal prices.

London.—FURTHER TARIFF INCREASE AT HAMMERSMITH.—From the beginning of this year electricity charges in Hammersmith were increased but in spite of this it is estimated that there will be a deficiency of £15,380 on the current year's working. The Council was therefore recommended, at its meeting last week, to make a further addition to tariffs as from October 1st. In general the increase is being raised to 33⅓ per cent. on standard rates, except for the No. 8 tariff (15 per cent.) and Nos. 5 and 11, together with special agreements based on these tariffs (27½ per cent.). The Electricity Commissioners have been consulted and agree with the necessity for steps to be taken to produce additional income.

ST. PANCRAS ACCOUNTS.—At last week's meeting of the Borough Council it was reported that the March quarter interim trading accounts of the Electricity Department revealed a decrease in the total sales of electricity of approximately 16 per cent. as compared with the corresponding period last year, and there was a trading deficit of £6,168 against a net profit last year of £4,082. The anticipated result of the year's trading, as disclosed by the four quarterly interim trading accounts, was a net profit of £6,388. Estimates for the ensuing six months, which it is pointed out are very problematical owing to the exceptional conditions prevailing, indicate a deficit of £27,349 for the financial year ending March 31st, 1942. It is not proposed to recommend a charge upon the general rate fund at the moment the matter being deferred for further examination and report.

Arrangements have been made for additional protection against enemy action at the power station and switch-house at an estimated cost of £2,950, subject to the approval of the Electricity Commissioners and the C.E.B. Precautionary measures have also been devised to safeguard the distributing system at a cost of £563. The replacement of high-voltage switchgear at a cost of £2,768 for the purpose of meeting load development has been authorised.

PROTECTIVE MEASURES AT HACKNEY.—Representations were recently made that the expenditure to be incurred in the replacement of the roofs of substations of the Electricity Department should be approved under Section 42 (2) of the Civil Defence Act, 1939. The Electricity Commissioners have, however, informed the Council that they are unable to recognise such works as being a measure within the scope of that section of the Act.

SHELTER IMPROVEMENTS.—Paddington Emergency Committee has authorised the borough engineer to provide improved lighting, ventilation and drainage at shelters. At Westminster the City Council proposes to have 117 electric heaters installed in shelters at a cost of £6,000, and St. Pancras Emergency Committee is to install lighting with dimming arrangements and traffic warning lights in certain shelters at a cost of £1,508. Lewisham Civil Defence Committee recommends the installation of electric lighting in shelters at a cost of £1,974. Poplar Emergency Committee is to provide 320 electric heaters in public and communal shelters at a cost of £4 each.

COST OF HEATING SHELTERS.—Bermondsey Emergency Committee recently reported that it was now a compulsory duty of the local authority to install electric heaters in certain shelters, and while the expenditure incurred in the installation was fully repayable, the supply of electricity was grant-aided to the extent of only 75 per cent. The cost to the borough would be approximately £25 per annum for each shelter housing 50 persons and on the same ratio per person for the larger shelters, and this would mean a very considerable expenditure. The Committee therefore recommended that representations should be made to the Ministry of Health for the expenditure incurred in the supply of electricity to public air-raid shelters to be fully repayable.

Northwich.—MODIFIED LIGHTING.—The surveyor to the Rural District Council is to prepare a scheme of low-intensity lighting for all parishes.

Portsmouth.—NEW WATER CIRCULATING SYSTEM.—The City Council has approved a proposed water circulating scheme. The original system has been extended from time to time, but it is now considered necessary to adopt a major scheme which, it is estimated, would result in considerable fuel savings. The proposed system

would utilise an existing pumping station together with a pipe system to a point of discharge on the open sea. The Council has agreed to appoint Mr. W. Muirhead as consulting engineer.

South Shields.—BULK SUPPLY AGREEMENT.—An agreement has been reached between the Town Council and the Central Electricity Board, concerning the Board's claim for loss of revenue consequent upon the Corporation taking a bulk supply for part of its area from the North-Eastern Electric Supply Co., Ltd. The agreement stipulates that until December, 1944, or December of the year following that in which the war ends, whichever is the later, or any other date mutually agreed upon, the Corporation shall be entitled to take such supply from the North-Eastern Electric Supply Co., Ltd. In consideration of this concession the Corporation shall pay £400 per annum to the Central Electricity Board as from January 1941, until the Corporation takes directly from the Board all electricity required for the area.

Stoke-on-Trent.—DISTRIBUTION SCHEMES.—The Corporation Electricity Committee is to replace switchgear at Goldendale substation at a cost of £700. A supply is to be provided to houses in Biddulph Road, Brindley Ford, at a cost of £300, and an additional supply given to premises in Knutton Road, Wolstanton, at a cost of £110. Consent has been obtained to the erection of overhead lines to provide supply to Fenton Road, Bucknall, and Birches Head Road, Hanley. The Committee is to complete the e.h.v. ring main to improve the supply in the northern part of the city at a cost of £1,950.

Stretford. — SHELTER INSTALLATIONS. — The Town Council has obtained sanction to have 197 public shelters lighted and heated by electricity at a cost of £6,608.

Thorne (Yorks). — MODIFIED LIGHTING. — A special meeting of the Council is being held to consider whether modified lighting shall be provided. When the matter was raised recently the clerk pointed out that such lighting would not cost much more than the Council was already paying under the agreement with the electricity company.

Wolverhampton.—SHELTER HEATING EXPERIMENTS.—The Corporation Emergency Committee is experimenting with regard to the type of electric heating to be installed in shelters.

Wood Green.—SHELTER HEATING.—The Corporation Emergency Committee has asked the borough engineer to prepare a scheme for heating public trench shelters by electricity. It has already been arranged for electric heating units to be installed at Woodall House shelter at a cost of £30.

Overseas

Eire.—INAUGURATION OF LIFFEY PLANT.—Our Dublin correspondent learns from recent inquiries that the Electricity Supply Board expects, should no unforeseen difficulties arise, to inaugurate the new Poulaphouca power station (Liffey scheme) in February next.

HYDRO-ELECTRIC PROJECTS.—Engineers of the Board have completed a survey of the Liffey at the Salmon Leap, Leixlip, where there is a fall of about 60 ft. Preliminary plans of a project for deriving power from the river have been made. For some time borings have been carried out on the River Erne, where the fall is roughly 140 ft. Other preliminary studies include investigations of the Rivers Lee (fall 100 ft.), Boyne (80 ft.) and Barrow (50 ft.). Smaller schemes that are being examined in Kerry include one near Killarney (fall 600 ft.), another at Waterville (150 ft.) and a third at Caragh Lake (60 ft.). Detailed surveys are to be made.

TRANSPORT

Canada. — TROLLEY-BUS MANUFACTURE IN WINNIPEG.—The *Christian Science Monitor* states that the Winnipeg Electric Co. has placed a contract for the manufacture of a trolley-bus in Winnipeg, and it is believed that this will be the first to be built in Canada. It will be a test vehicle and if satisfactory more will be constructed. This step is being taken because the company has been informed that the importation of trolley-buses from America cannot be permitted at present. The company was one of the first in Canada to use trolley-buses and now has 16 in service, besides 196 trams and 113 motor-buses. A modernisation scheme costing $2,000,000 has been drawn up under which it is proposed to purchase a further 60 trolley-buses.

Germany.—FEWER TRAMS IN BERLIN.—It is reported that owing to the shortage of labour and the need for economy in electricity twenty-one Berlin tram services are being withdrawn.

South Shields.—TROLLEY-BUS SERVICE EXTENSION.—The Ministry of War Transport has approved a proposal by the Town Council to extend the trolley-bus service from Laygate Circus to South Eldon Street.

Fuel Economy Campaign

IN conjunction with efforts now being made by the National Joint Gas & Electricity Committee to avert the rationing of gas and electricity, the British Electrical Development Association—with the other fuel industries—is collaborating with the Mines Department in promoting the Government's Fuel Economy Campaign. A series of Fuel Economy advertisements have already appeared in the national Sunday Press and the Mines Department is developing the campaign by direct approach to large-scale consumers such as Government and Service Departments, hotels, restaurants, clubs, etc.

The Mines Department hopes shortly to issue a complete programme of the Fuel Economy Campaign comprising, mainly, instructional Press advertisements in London and provincial evening newspapers; reminder advertisements in the national Press; broadcast talks, and films in the cinemas ; posters and other items of publicity are also promised and the co-operation of electricity supply undertakings in their distribution is being invited. A small gummed slip to attach to accounts is being prepared for free issue to electricity and gas undertakings.

The Association is producing a series of local advertisements and a fuel economy chart which undertakings have also been invited to distribute. The Association has been endeavouring to persuade the Mines Department to produce letters or leaflets and circulate them to all fuel consumers. It seems likely that it may succeed in the former request, but that the Mines Department will look to the electricity and gas undertakings to circulate them with accounts, by meter readers or by any other convenient method.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Berry's Electric, Ltd., report a much improved result for the year to March 31st last. The profit, after providing for depreciation, was £14,588, against £1,761. After meeting income tax, war risk insurance, staff pension fund contribution and interest a net profit of £7,031 remained, against a loss of £5,823 in 1939-40. The bulk of this is transferred to reserves, £1,900 being carried forward. The last dividend paid was 4½ per cent., free of tax, three years ago.

Bennis Combustion, Ltd., reports a profit for the year ended April 30th, of £28,883, as compared with £29,371 for 1939-40. Provision for income tax and E.P.T. is £12,500, War Damage Insurance, £550, and staff fund £1,000, leaving a net profit of £14,833. The ordinary dividend for the year is maintained at 10 per cent., general reserve receives £1,000, and the balance carried forward is £3,549 (against £3,216 brought in). The report states that the works have been employed to full capacity and that production continues to show a steady increase.

The British Vacuum Cleaner & Engineering Co., Ltd., reports a profit for the eighteen months to March 31st, of £46,983, and after writing off depreciation of plant, premises, etc., there is a net profit of £25,910 as against £29,783 for the previous year. To the net profit is added £12,442 brought in, making £38,352 available. The ordinary dividend is 10 per cent. (against 12½ per cent.), and £10,977 is carried forward.

At the annual meeting on Monday last the chairman (Mr. H. C. Booth) said that a further statement of accounts would be made up as soon as possible to incorporate the trading results for the period from March 31st to September 30th, 1941, in order to conform to the company's normal financial year.

Jerusalem Electric & Public Service Corporation, Ltd.—Presiding at the annual meeting held on September 24th, Mr. W. Shearer (chairman) said that owing to the extension of the war to the Middle East the year under review had been one of anxiety and it was not surprising that the steady progress maintained in past years had been interrupted. The surplus on operating and sundry receipts at £P66,631 showed a reduction of £P9,875 as compared with the preceding year, largely accounted for by increases in operating costs and, in a minor degree, by loss of revenue due to lighting restriction regulations. Against this it was encouraging that the total number of kWh sold showed little reduction on the previous year. While regretting its necessity the board felt sure that members would recognise the prudence under existing circumstances of the reduction in the ordinary share dividend and the importance of maintaining the various allocations for depreciation, etc.

Richard Johnson, Clapham & Morris, Ltd., report a trading profit for the year to June 30th, after allowing for depreciation, of £30,603, as compared with £30,186 in the previous year. The final ordinary dividend is 11¼ per cent., again making 15 per cent. for the year.

The Kalgoorlie Electric Tramways, Ltd., reports a net profit for 1940 of £1,971, before deducting "B" debenture interest as compared with £875 for the preceding year, which is transferred to sinking fund for debenture redemption. The debit carried forward after allowing for debenture interest accrued is £153,868 against £150,095 brought in. During the year a further distribution of 1 per cent. on account of "B" debenture capital was made.

The Mexican Light & Power Co. announces that adjourned meetings of holders of certain of the company's securities are to be held on October 21st and 22nd. At meetings called for September 24th, to consider a scheme of arrangement quorums were present of holders of the 5 per cent. second mortgage 50-year bonds and debenture stock and 6 per cent. cumulative income debenture stock but not of the other classes.

The Ransome and Marles Bearing Co., Ltd., reports a trading profit, after deducting depreciation, E.P.T. and income tax, of £113,795 as compared with £162,653 for the preceding year, and a net profit of £113,295, a decrease of £49,743. The dividend for the year is again 20 per cent., less tax, and after deducting £10,000, extra taxation on 1939-40 profits, War Damage Insurance, £27,000, and £3,000 directors' remuneration, the balance carried forward is £76,305 (against £77,735 brought in).

The Radiovisor Parent Co., Ltd., reports a trading loss for the year to March 31st of £2,155, as compared with £2,739 for 1939-40, plus interest, depreciation, etc., making £2,668 (against £3,516). The debit carried forward is £33,411 (against £30,743 brought in).

J. Blakeborough & Sons, Ltd., are paying a final ordinary dividend of 5 per cent. and a bonus of 10 per cent., making a total of 20 per cent. for the year (against 10 per cent. last year). The net profit rose by £67,178 to £149,258.

The Shropshire, Worcestershire and Staffordshire Electric Power Co. is maintaining its interim dividend at 4 per cent. on the "A" ordinary and 2½ per cent. on the "B" ordinary shares, both less tax.

The Wessex Electricity Co. is again paying an interim dividend of 1½ per cent.

The South Wales Electric Power Co. has declared an interim dividend of 2 per cent (unchanged).

The Urban Electric Supply Co., Ltd., has declared an interim ordinary dividend of 4 per cent. (same).

The Cornwall Electric Power Co. announces the payment of 3½ per cent. interim upon its 7 per cent. preference shares.

The Ascot District Gas & Electricity Co. is paying an interim dividend of 2½ per cent. (unchanged).

The Oriental Telephone Electric Co., Ltd., is again paying an interim ordinary dividend of 5 per cent., less tax.

The Lancashire Dynamo & Crypto, Ltd., has declared an interim dividend of 5 per cent. (unchanged).

Ericsson Telephones, Ltd., has declared an interim ordinary dividend of 5 per cent., tax free (same).

Hopkinsons, Ltd., are again paying an interim dividend of 5 per cent.

The Ebonite Container Co., Ltd., is paying an interim dividend of 5 per cent. (same).

New Companies

Industrial Fan & Heater Co., Ltd.—Private company. Registered September 18th. Capital, £5,000. Objects: To carry on the business of heating, ventilating, refrigerating and constructional engineers, etc. Directors: A. N. Brand, 1, Carter Lane, Quinton, Birmingham, 32, L. H. Slade, 276, Stratford Road, Shirley, nr. Birmingham, and C. W. Green, 40, Cherry Orchard Road, Handsworth Wood, Birmingham. Registered office: 54, Poplar Avenue, Edgbaston, Birmingham.

J. H. Collie & Co., Ltd.—Private company. Registered September 17th. Capital, £500. Objects: To acquire the business of an electrical and mechanical engineer carried on by James H. Collie, at 25, Grange Road, Birkenhead. J. H. Collie, 22, Hill Road, Birkenhead, Ches., is permanent director while holding 100 shares. Secretary: H. P. V. Williams, 60, Castle Street, Liverpool. Registered office: 25, Grange Road, Birkenhead, Ches.

E. C. Handcock, Ltd.—Private company. Registered in Dublin September 13th. Capital, £10,000. Objects: To carry on the business of general, mechanical and electrical engineers, machinists, fitters, etc. Directors: E. C. Handcock, M.I.E.E., 17, Fleet Street, Dublin, and Mrs. M. Handcock, Capri, Dublin Road, Sutton, Co. Dublin.

Companies' Returns

Statements of Capital

Kent Bros. Electric Wire Co., Ltd.—Capital, £40,000 in 11,500 "A" ordinary, 3,500 "B" ordinary and 25,000 preference shares of £1 each. Return dated June 4th, 1941. 11,500 "A" ordinary, 2,300 "B" ordinary and 25,000 preference shares taken up. £27,800 paid on 500 "A" ordinary, 2,300 "B" ordinary and 25,000 preference shares. £11,000 considered as paid on 11,000 "A" ordinary shares. Mortgages and charges: Nil.

A. Hirst & Son, Ltd.—Capital, £20,000 in 100 preference and 1,900 ordinary shares of £10. Return dated June 9th, 1941. 100 preference and 1,220 ordinary shares taken up. £2,200 paid on 100 preference and 120 ordinary shares. £11,000 considered as paid on 1,100 ordinary shares. Mortgages and charges: Nil.

R. F. Winder, Ltd.—Capital, £12,000 in £1 shares. Return dated June 9th, 1941. 10,300 shares taken up. £10,300 paid. Mortgages and charges: Nil.

Tricity Cookers, Ltd.—Capital, £20,000 in 20,000 shares of £1 each. Return dated June 9th. 19,990 shares taken up. £17,741 paid. £2,249 considered as paid. Mortgages and charges: £10,000.

Vactite Wire Co. (1919), Ltd.—Capital, £25,000 in £1 shares. Return dated June 11th. 15,000 shares taken up. £3 paid. £14,997 considered as paid. Mortgages and charges: £10,000.

Mortgages and Charges

Arc Manufacturing Co., Ltd. — Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated August 21st, 1941, to secure £7,000 (ranking *pari passu* with existing debenture). Holders: Branch Nominees, Ltd.

Campbell & Isherwood Ltd.—Satisfaction to the extent of £700 on August 13th, 1941, of charge dated July 5th, 1939, and registered July 7th, 1939. According to the register of mortgages the charge registered July 7th, 1939, originally secured £700.

William Steward & Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated September 4th, 1941, to secure £3,000. Holders: Branch Nominees, Ltd.

Underwood (Electric), Ltd.—Assignment on September 10th, 1941, of proceeds of certain contracts, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £900.

Page & Miles, Ltd.—Satisfaction in full on September 4th, 1941, of debenture dated March 19th, 1941, and registered April 7th, 1941, securing £1,200.

Liquidations

Robinson & Hands Electric Co., Ltd.—Meeting October 28th at the offices of Corfield & Cripwell, 12, Cherry Street, Birmingham, to hear an account of the winding up by the liquidator, Mr. A. Cripwell.

Savoy Refrigerator & Manufacturing Co., Ltd.—Meetings October 30th at the offices of Cooper & Cooper, 48, Fenchurch Street, London, E.C.3, to hear an account of the winding up by the liquidator, Mr. R. G. Tiplady.

Edgware & Stanmore Electrical Co., Ltd.—Meetings October 31st at the offices of Stoker Lee & Co., 227, Holland Park, London, W.11, to hear an account of the winding up by the liquidator, Mr. F. J. L. Willey.

Bankruptcies

W. Cornell, trading as W. T. Cornell, electrical engineer, builder, and decorator, 33, Holland Street, Kensington, London, W.8.—Application for discharge to be heard on October 22nd at Bankruptcy Buildings, Carey Street, London, W.C.2.

Irene F. Berners and C. J. Berners, battery manufacturers, trading as the Major Manufacturing Co., 98, Great Tower Street, London. Trustee, Mr. M. M. Donn, Astor House, Aldwych, London, W.C.2, appointed September 15th.

J. K. Thornborough and E. C. Thornborough, electricians, carrying on business as J. K. Thornborough & Co., at Crescent Road, Windermere (separate estate of E. C. Thornborough).—Claims for dividends by October 10th to the Official Receiver, Mr. W. G. Pearson, 16, Cornwallis Street, Barrow-in-Furness.

STOCKS AND SHARES

TUESDAY EVENING.

THE course of the Stock Exchange market is being dictated, rather more than usual, by the war news from the Russian fronts. Fundamentally, the financial position is unchanged, in that the Government's policy of cheap money serves to uphold prices of existing securities, and the ban placed upon new issues acts as an indirect lever for maintaining quotations in the industrial market.

Interim dividends are mostly at the same rates as those of twelve months ago; Ericsson Telephones, for instance, paying 5 per cent., tax free, South Wales Electric 2 per cent., Wessex Electricity 1½ per cent., etc. Our price-lists contain comparatively few changes this week, after their almost unbroken series of six weeks of many price improvements. An outstanding feature is a rise of five points in Rio Tramway bonds, due to a revival of confidence and of interest in Brazilian securities.

Price Fluctuations

London Passenger Transport "C" stock at 43 is a point down, but Southern Railway stocks are harder. The market is waiting for publication of the White Paper which will apportion the amount of war damage which the Government will fix as being the liability of the railways. When this is made known, the outlook for Home Railway stocks should be at least clarified. British Electric Traction deferred holds its rise at 885 and Tilling shares are very steady at 46s. 3d. The cable group is uninteresting. Great Northern Telegraphs are 10s. up at 14½. Amongst the industrial ordinary shares falls have taken place of $\frac{1}{16}$ in Murex to 87s. 6d. and in Tube Investments to 92s. 6d. Ericssons at 40s. are up 2s. 6d. Allen West strengthened to their par price of £s. Electricity supply shares remain a good market. Midland Electric Power have advanced to 38s. 9d. Both the Yorkshire shares are 9d. up. Isle of Thanet put on 1s. and West Gloucesters $\frac{1}{16}$ to 19s. 6d. In the Overseas list, Victoria Falls went back $\frac{1}{8}$ to 77s. 6d. Further inquiry for Whitehall preference brought about an improvement to 14s. 6d. Midland Electric Manufacturing at 5⅛ are the fraction to the good. British Electric Resistance florin shares rose to 2s. 9d.

Dividends in U.S.A.

Prices of industrial shares quoted in the New York Stock Exchange have been sharply shaken by the drafting of a Bill in Washington, having for its object the limitation of dividends to 6 per cent. This caused abrupt falls in shares of companies whose dividends might conceivably be affected. Oddly enough, it had a mild repercussion on this side, for some people immediately started to talk about the possibility of a 6 per cent. maximum dividend being applied to British concerns. The fear is too fantastic for it to deserve more than a passing notice as an instance of the extent to which imagination can stretch in these war days. The United States proposals, if they come to anything at all, which seems unlikely, are no more than a drastic form of E.P.T.

Dollar Stocks

The demand for dollar shares, which was started by a somewhat dramatic jump in the price of Brazilian Tractions, has quietened down. Montreal Light & Power failed to hold their rise and have reacted to 26½; Shawinigan dropped back to 16½. The "A" dollar shares of the British Columbia Power Company, of no par value, have come on offer at 32½. The company is paying quarterly dividends at the rate of $2 per annum. The yield at the price mentioned is a shade over 6 per cent. The shares are amongst the few dollar shares in which British investment is permitted. So far as can be gathered from the details available, the outlook for the company seems to be promising, and for those who are drawn to dollar issues as holding a prospect of increase in capital value, British Columbia Power "A" shares may present attraction. The rise in Rio Tramways bonds has lifted the price to 90.

Electrical Manufacturing Preference

Continuing the practice of giving a selection of securities actually on offer in the Stock Exchange market at the time of writing, here is a brief list of cumulative preference shares of £1 each. A reasonable amount can be obtained at the prices mentioned:—

Preference share	Dividend %	Price s. d.	Yield £ s. d.
British Thomson-Houston ..	7	33/9	4 3 0
Consolidated Signals ..	6	24/6	4 18 0
English Electric	6½	31/–xd	4 3 9
General Electric	6½	32/9	3 19 3
do.	7½	36/9	4 1 6
Walsall Conduits	5	22/6–xd	4 8 9

The General Electric 6½ per cent. dividend service takes £62,900 annually, to meet which there was a profit in the last-published accounts of £1,067,000. The annual requirement for the G.E.C. second preference dividend is £72,600, towards which the company had £1,046,000. In the case of Walsall Conduits, the preference dividend payment was covered 17½ times by the last-published figures, and towards the British Thomson-Houston dividend of £60,300, £488,000 was available. The Consolidated Signals preference dividend was covered three times; that of the English Electric rather more than six times, by the profits given in the latest-issued accounts.

Six Months' Review

The Stock Exchange financial year runs from the end of March and, as the first half of the year 1941/2 has just closed, it becomes of interest to look back at prices which obtained

(*Concluded on page* 349)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Sept. 30	Rise or Fall	Yield £ s. d.
Home Electricity Companies					
Bournemouth and Poole	15	12½	52/6	..	4 15 5
British Power and Light	7	6	25/–	..	4 16 0
City of London	7½	7	25/9	..	5 8 9
Clyde Valley	8	8	37/6	..	4 5 4
County of London	10½	8	35/9	..	4 9 5
Edmundson's:					
7% Pref.	7	7	32/6	..	4 6 2
Ord.	6	6	27/6	..	4 7 3
Elec. Dis. Yorkshire	9	9	40/9	+9d.	4 8 3
Elec. Fin. and Securities	12½	12½	42/6	..	5 17 8
Elec. Supply Corporation	11½	10	42/6	..	4 14 0
Isle of Thanet	2	Nil	9/–	+6d.	—
Lancs Light and Power	7½	7½	33/9	..	4 9 0
Llanelly Elec.	5½	5½	21/–	..	5 4 9
Lond. Assoc. Electric	5½	4½	19/6	..	4 12 4
London Electric	7	7	24/6	..	5 14 3
London Power Deb. Red.	5	5	103	..	4 17 2
Metropolitan	10	8	36/3	..	4 8 5
Midland Counties	8	8	38/3	..	4 3 4
Mid. Elec. Power	9	9	38/9	+1/16	4 13 0
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec.:					
Ordinary	7	7	29/6	..	4 15 0
7% Pref.	7	7	32/6	−9d.	4 6 2
Northampton	10	10	44/6	..	4 10 0
Notting Hill 6% Pref. (£10)	6	6	8½	..	—
Northmet Power:					
Ordinary	10	7	35/–	..	4 0 0
6% Pref.	6	6	29/6	..	4 1 4
Richmond Elec.	6	6	22/6	..	5 6 8
Scottish Power	8	8	38/3	..	4 3 4
Southern Areas	5	5	17/6	..	5 14 3
South London	7	7	23/6	..	5 19 2
West Devon	5	5	21/3	..	4 14 1
West Glos.	4½	4½	19/6	+1/16	4 12 4
Yorkshire Elec.	8	8	39/6	+9d.	4 1 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	3/3	..	—
Calcutta Elec.	8*	7*	37/–	..	3 15 9
Cawnpore Elec.	10	10	28/3	..	7 1 7
East African Power	7	7	25/9	..	5 8 9
Jerusalem Elec.	7	5	18/9	..	5 6 8
Kalgoorlie (10/–)	7½	7½	13/6	..	5 13 2
Madras Elec.	6*	4*	21/3	..	3 15 1
Montreal Power	1½	1½	26½	−1½	5 13 2
Palestine Elec. "A"	Nil	Nil	18/3	..	—
Perak Hydro-elec.	2½	6	18/9	+6d.	6 8 0
Shawinigan Power	83cts.	90cts.	16½	−1	—
Tokyo Elec. 6%	6	6	36½	..	16 8 8
Victoria Falls Power	15	15	77/6	−½	3 17 5
Whitehall Inv. Pref.	7½	7½	14/6	+9d.	10 6 10

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Sept. 30	Rise or Fall	Yield £ s. d.
Public Boards					
Central Electricity:					
1950–70	5	5	110	..	4 11 1
1955–75	5	5	113	..	4 8 6
1951–73	4½	4½	107	..	4 4 1
1963–93	3½	3½	102	..	3 8 8
1974–94	3½	3½	94	..	3 9 2
London Elec. Trans. Ltd.	2½	2½	95	..	2 12 8
London & Home Counties 1955–75	4½	4½	106½	..	4 4 6
Lond. Pass. Trans.:					
A	4½	4½	113½	..	3 19 4
B	5	5	113½	..	4 8 1
C	1½	3	43	−1	6 19 6
West Midlands J.E.A. 1948–68	5	5	108½	..	4 12 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	107½	..	5 11 9
Def.	1½	1½	24½	..	6 2 5
Anglo-Portuguese	8	8	15/–	..	10 13 4
Cable & Wireless:					
5½% Pref.	5½	5½	103	..	5 6 10
Ord.	4	4	62	−1	6 9 1
Canadian Marconi $1	Nil	4cts.	6/–	..	3 6 0
Globe Tel. & Tel.:					
Ord.	8½*	8½*	28/9	..	—
Pref.	6	6	27/6	..	4 7 3
Great Northern Tel. (£10)	20	20	14½	+½	—
Inter. Tel. & Tel.	Nil	Nil	3	..	—
Marconi-Marine	7½	7½	26/3	..	5 14 1
Oriental Tel. Ord.	11½*	16	3½	..	4 8 6
Telephone Props.	6	6	11/3	..	10 13 4
Tele. Rentals (5/–)	10	10	9/–	..	5 11 3
Traction and Transport					
Anglo. Arg. Trams:					
First Pref. (£5)	Nil	Nil	2/–	..	—
4% Inc.	Nil	Nil	7½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	885	..	5 1 8
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8*	8	41/3	..	3 17 8
Brazil Traction	$1	50c.	10½	..	—
Calcutta Trams	8	5½	23/9	..	4 12 7
Cape Elec. Trams	5	5	19/–	..	5 5 3
Lancs Transport	10	10	42/6	..	4 14 1
Mexican Light:					
1st Bonds	5	5	55	..	—
Rio 5% Bonds	5	5	90	+5	5 11 1
Southern Rly.:					
5% Prefd.	5	5	62½	+1	8 0 0
5% Pref.	5	5	98½	+1	5 1 7
T. Tilling	10	10	46/3	..	4 6 7
Tilling & B.A.	8*	7*	52/6	..	2 13 4
West Riding	10	10	39/–	..	5 2 7

(Continued on next page)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Sept. 30	Rise or Fall	Yield p.c.
Equipment and Manufacturing					
			£ s. d.		
Aron Elec. Ord. ..	Nil	7½	22/–	..	6 16 4
Assoc. Elec.:					
Ord.	10	10	43/9	..	4 16 3
Pref.	8	8	36/3	..	4 8 5
Automatic Tel.& El.	12½	12½	46/3	..	5 8 3
Babcock & Wilcox	11	11	45/–	..	4 17 9
British Aluminium	12½	10	44/6	..	4 10 0
British Insul. Ord...	20	20	90/–	..	4 9 0
British Thermostat (5/-)	18½	18½	13/9	..	6 14 6
British Vac. Cleaner (5/-)	12½	10	11/3	..	4 9 0
Brush Ord... ..	Nil	Nil	4/–	..	—
Callender's ..	15	15	70/–	..	4 5 9
Chloride Elec. Storage	15	15	67/6	+⅛	4 9 0
Consolidated Signal	17	17	75/–	..	4 10 10
Crabtree (10/-) ..	17½	17½	28/9	..	6 1 9
Crompton Parkinson Ord. (5/-) ..	30	20	19/6	..	5 2 8
E. K. Cole (5/-) ..	10	Nil	6/9	..	—
E.M.I. (10/-) ..	5	Nil	12/3	–6d.	—
Electric Construction	10½	10	32/6	..	6 3 0
Enfield Cable Ord.	16½	12½	51/3	..	4 17 6
Elecl. Switchgear (10/-)	16	10	20/–	..	5 0 0
English Electric ..	10	10	35/–	..	5 14 2
Ensign Lamps (5/-)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/-) ..	25*	22*	40/–	+⅛	2 13 4
Ever Ready (5/-) ..	40	40	28/6	..	7 0 4
Falk Stadelmann ..	7	7½	17/6	..	8 11 6
Ferranti Pref. ..	7	7	26/3	..	5 6 10
G.E.C.:					
Pref.	6½	6½	32/6	..	4 0 0
Ord.	20	17½	77/6	..	4 10 2
Greenwood & Batley	15	13	22/6	..	11 11 2
Hall Telephone (10/-)	15	10	15/–	..	6 13 4
Henley's (5/-) ..	20	20	21/3	..	4 14 1
4½% Pref. ..	4½	4½	21/3	..	4 4 8
Hopkinsons ..	15	15	45/9	..	6 11 0
India-Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion ..	32½	30	105/–	..	5 14 3
J. Lucas	15	15	6¼/3	..	4 18 0
Johnson & Phillips	15	15	52/6	..	5 14 3
Lancashire Dynamo	20	20	61/3	..	6 10 6
Laurence, Scott (5/-)	15	15	10/9	..	6 19 6
London Elec. Wire	7½	7½	22/6	..	6 13 4
Mather & Platt ..	13½	10	42/6	..	4 14 1
Metropolitan Elec. Cable Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	87/6	–1/6	4 11 4
Pye Deferred (5/-)..	25	25	13/9	..	9 1 10
Revo (10/-) ..	5	20	23/9	..	8 8 5
Reyrolle	12½	12½	55/–	..	4 10 3
Siemens Ord. ..	7½	7½	23/9	..	6 6 4
Strand Elec. (5/-) ..	4	2	3/–	..	3 6 8
S. Smith (4/-) ..	37½	50	7/–	..	7 2 10
Switchgear & Cowans (5/-)	10	15	8/9	..	8 11 6
Tel. Condenser (10/-)	Nil	5	11/3	..	4 9 0
T.C. & M.	10	10	41/3	..	4 17 0
Telephone Mfg. (5/-)	9	9	8/3	..	5 9 1
Tube Investments..	23¾	23¾	92/6	–1/6	5 2 8
Vactric (5/-) ..	4	Nil	3/–	..	—
Vickers (10/– ..	10	10	17/3	..	5 16 0
Ward & Goldstone (5/-)	20	20	16/6	..	5 19 9
Westinghouse Brake	17½	10	47/6	..	4 4 4
Walsall Conduits (4/-)	55	55	31/3	..	7 0 9
West, Allen (5/-) ..	7½	7½	5/–	+1/6	7 10 0

* Dividends are paid free of Income Tax.

Stocks and Shares

(*Continued from page* 347)

at the end of last March, comparing these with quotations current to-day. Taking a very few examples more or less at random, here is a representative catalogue of movements in electrical and allied investments:—

Stock or Share	March 26th	Now	Rise
County of London Elec. ..	30s. 9d.	35/9	5/–
Lancashire Light & Power ..	30s.	33/9	3/9
Scottish Power	34s. 3d.	38/3	4/–
Yorkshire Electric	37s. 6d.	39/6	2/–
Globe Telegraph ord. ..	28/9	28/9	—
Cable & Wireless pref. ..	100	103	3
Oriental Telephone	2¾	3⅝	17/6
Southern Rly. prfd. ..	48½	62½	14
do. pref.	87½	98½	11
B.E. Traction defd.	800	885	85
T. Tilling	42/6	46/3	3/9

Manufacturing and Equipment

This group makes an equally satisfactory showing, as the ensuing figures illustrate. General Electrics are rather lower over the period, on account of disappointment with the reduction of the dividend by 2½ per cent. Nine other examples hereunder mark improvements that range from 1s. 3d. to 8s. 9d., as follows:—

Stock or Share	March 26th	Now	Rise
British Insulated	81/3	90/–	8/9
Callender's	63/9	70/–	6/3
Enfield	47/6	51/3	3/9
English Electric	31/3	35/–	3/9
Ericssons	35/–	40/–	5/–
Henley's	20/–	21/3	1/3
Johnson & Phillips	45/–	52/6	7/6
Siemens	20/–	23/9	3/9
Telephone Mfg.	7/–	8/3	1/3

Difficulties in Dealing

The famine in the supply of ordinary shares in the best class of industrial companies would be almost amusing if it were not distinctly exasperating. The exasperation comes to the prospective purchaser who wants the shares for permanent keeping, while his Stock Exchange broker, and the jobber who deals in the particular shares that are required, feel aggrieved at being unable to carry out the wishes of the public. It may not be difficult to deal in 50 or 100 shares, through every now and then the intending buyer finds that not even 100 shares are to be obtained. Shares can be sold readily enough, but the dealer who buys them may already be short of them and wants what he buys in order to fulfil sales made previously.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1939

30870. "Remote-control of moving objects by means of radiant energy." G. W. Walton. November 27th, 1939. (539224.)

31142. "Gyroscopic apparatus." Sperry Gyroscope Co., Inc. December 17th, 1938. (539225.)

31291. "Position-indicating systems." Sperry Gyroscope Co., Inc. December 9th, 1938. (539321.)

33097. "Electrical calculating device." International Business Machines Corporation. January 10th, 1939. (539322.)

1940

81. "Electric tumbler switches." J. H. Tucker & Co., Ltd., and F. C. Fuke. January 2nd, 1940. (539323.)

1871. "Primary electric cells, and the method of making the same." B. T. Hewson and A. Locan. January 30th, 1940. (539232.)

1879. "Click stop devices suitable for use for spot wave selection in radio receivers, and for like purposes." Marconi's Wireless Telegraph Co., Ltd., F. E. Baum and T. N. D. Phillips. January 30th, 1940. (539233.)

1910. "Electric circuit controllers." Igranic Electric Co., Ltd. February 1st, 1939. (539268.)

3051. "Operation of electric-discharge lamps." British Thomson-Houston Co., Ltd., and H. K. Bourne. February 17th, 1940. (Cognate application 13149/40.) (539382.)

3867. "Alternating-current electric circuit-breakers." A. Reyrolle & Co., Ltd., J. A. Harle and R. W. Wild. March 1st, 1940. (539236.)

3868. "Distress buoys and the like." International Marine Radio Co., Ltd., and W. H. McAllister. March 1st, 1940. (539237.)

3891. "Rotary power-transmission mechanism." H. Sinclair. March 1st, 1940. (539241.)

3870. "Electro-magnetic switches." Standard Telephones & Cables, Ltd., and P. A. Childs. March 1st, 1940. (539238.)

3900. "Devices for electric remote control." G. K. Tolnai and Aktiebolaget Gerh. Arehns Mekaniska Verkstad. March 1st, 1939. (539242.)

3916. "Sparking plugs." K.L.G. Sparking Plugs, Ltd., and C. M. Carington. March 1st, 1940. (539244.)

3955. "Power transmission mechanisms." Snow & Petrelli Manufacturing Co. January 16th, 1940. (539301.)

3969. "Means for operating gas-discharge lamps." J. Lucas, Ltd., and J. A. Laird. March 2nd, 1940. (539282.)

4034. "Phase failure and overload protective systems." Igranic Electric Co., Ltd. March 3rd, 1939. (539334.)

4092. "Thermionic amplifiers." Standard Telephones & Cables, Ltd., A. H. Roche and A. J. Buxton. March 5th, 1940. (539360.)

4093. "Clutches." Standard Telephones & Cables, Ltd., N. H. Martin and K. Mitchell. March 5th, 1940. (539361.)

4167. "Telephone or like systems." Automatic Telephone & Electric Co., Ltd. April 27th, 1939. (539283.)

4402. "Control equipments for electric motors." H. K. Ramsden, H. N. W. Kettlewell, and Metropolitan-Vickers Electrical Co., Ltd. March 8th, 1940. (Cognate application 10110/40.) (539246.)

5213. "Wireless receiving sets comprising dial lamps." General Electric Co., Ltd., and A. J. Biggs. March 20th, 1940. (Cognate application 8461/40.) (539370.)

5605. "Electric circuit-breakers of the gas-blast type." R. Rudenburg. March 28th, 1940. (539311.)

5730. "Electric gas-discharge tubes and starting arrangements therefor." Philips Lamps, Ltd. April 1st, 1939. (539287.)

6048. "Reduction gear devices." Marconi's Wireless Telegraph Co., Ltd., and G. Payne. April 3rd, 1940. (539289.)

6101. "Electric heating elements." General Electric Co., Ltd., and J. L. Rycroft. April 4th, 1940. (539313.)

6347. "Layers sensitised by means of a diazonium compound, and methods of preparing such layers." Philips Lamps, Ltd. April 11th, 1939. (539314.)

6356. "Electron-discharge apparatus." Electrical Research Products, Inc. May 27th, 1939. (539315.)

6715. "Suspension hooks." M. H. Goldstone. April 13th, 1940. (539338.)

6988. "Mountings for pilot or indicator lights." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and W. E. Hill. April 18th, 1940. (539318.)

8574. "Frequency demodulation." Marconi's Wireless Telegraph Co., Ltd. May 12th, 1939. (539254.)

10489. "Control means of electro-magnetically operated electric switches or circuit-breakers." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. June 17th, 1940. (539343.)

10673. "Overhead equipment of electric traction systems." British Insulated Cables, Ltd., London Passenger Transport Board, T. C. Broom and H. J. Powell. June 21st, 1940. (539345.)

11002. "Direction-finding system." Standard Telephones and Cables, Ltd. February 23rd, 1940. (539290.)

15160. "Electric heating elements of the sheathed wire type." British Thomson-Houston Co., Ltd. October 11th, 1939. (539375.)

16087. "Electric current transformers." British Thomson-Houston Co., Ltd. (Tokyo Shibaura Denki Kabushiki Kaisha). November 5th, 1940. (539376.)

1941

2039. "Electric motor controllers." Igranic Electric Co., Ltd. February 1st, 1939. (Divided out of 539268.) (539320.)

Amended Specification

535112. "Tripping arrangements for operating mechanism of electric circuit-breakers." General Electric Co., Ltd., and another.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Bridgend.—October 22nd. Electricity Department. Outdoor type switchgear and transformers. (September 26th.)

Dewsbury.—October 6th. Corporation. Lamps and cables. (September 19th.)

Luton.—October 6th. Corporation. Installation of electric lighting circuits in public surface shelters. (See this issue.)

Plymouth.—October 11th. Electricity Supply Department. Overhead travelling crane. (September 26th.)

South Africa.—SALISBURY. (S. RHODESIA).—October 13th. City Council. Stoker-fired water-tube boilers and other power station plant. (August 29th).

October 27th. Switchgear, transformers and reactors, together with auxiliary apparatus. (August 29th.)

October 27th. 90,000 lb. overhead electric travelling crane. (September 26th.)

DURBAN.—October 17th. City Council. Telephone cable (contract P.261). 72 transformers (contract E.2032).

POST OFFICE.—December 4th. Equipment for radio-telephone link between Maseru and Mokhotlong.

Twrcelyn.—October 14th. Rural District Council. Duplicate horizontal, motor-driven, seven-stage, turbine centrifugal pumps, each to lift 6,000 gal. per hr. against 330 ft. head, complete electric automatic starting and control apparatus, and distant water level transmitter at reservoir to govern the running of the plant. Contract No. 5. Particulars from Henry Adams & Son, civil engineers, Fron Heuloy, Bangor, North Wales.

Orders Placed

London.—STEPNEY.—Borough Council. Accepted. Metal-clad floor-fixing switchboard (£290).—English Electric Co. Test-room batteries (£115).—Hart Accumulator Co. Standard meter testing instruments (£375).—Cambridge Instrument Co. Meter testing equipment (£973).—Zenith Electrical Co. Repairs to electric hoist (£157).—Aldous & Campbell, Ltd. Fire-fighting equipment for power station (£260).—Fire Equipment, Ltd. Fire protection equipment for switch and transformer gear (£1,563).—National Fire Protection Co.

Renewal of annual contracts during 1941-42. AC meters.—Aron Electricity Meter, Ltd. DC prepayment meters.—Chamberlain & Hookham, Ltd. Maximum demand indicators (three months).—Reason Manufacturing Co. Conduits and troughs and covers (at revised prices).—Albion Clay Co.

ST. PANCRAS.—Borough Council. Accepted. Electric vehicle battery for Highways Department (£152).—Chloride Electrical Storage Co. Continuation for three years from August 1st, 1939, of contract for cable, subject to a general increase of 6 per cent. on present prices with an allowance for the omission of armouring in accordance with the prevailing price of steel.—Metropolitan Cable & Construction Co.

LEWISHAM.—Emergency Committee. Recommended. Provision of lighting in group shelters (£1,071, plus £903 for service connections).—South Metropolitan Electric Light & Power Co., Ltd. Electric lighting in semi-sunk shelters (£506).—A. J. Hewens & Sons, Ltd.

Middlesex.—Health Committee. Accepted. Electric cabling for well sinking works at Hillington Hospital (£283).—T. Clarke & Co.

Wood Green.—Emergency Committee. Accepted. Wiring at civic restaurant (£65).—Northmet Power Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Amble (Northumberland).—Rebuilding Coquet Hall Cinema; M.C.B. Cinemas, Ltd.

Ardrossan.—Adaptation of Unionist Club Rooms as British Restaurant; burgh surveyor, Burgh Chambers, Ardrossan.

Ashbourne.—Electrification of waterworks for U.D.C. (£2,000); H. Englis, electrical engineer, Council Offices, Compton Street.

Barnes.—British Restaurants at Westfields Schools, Archway Street and Fanny Road School; borough engineer, Council House, High Street, S.W.4.

Barnsley.—Kitchen at Littleworth School; Dyson, Cawthorne and Coles, architects, 25, Regent Street, Barnsley.

Basford.—Dairy, Gladstone Street; J. N. Rayson.

Burton-on-Trent.—Sewage pumping station, for R.D.C.; surveyor, Council offices, The Poplars, Rolleston Road, Burton-on-Trent.

Carlisle.—Shelters at two schools (£1,200) and school extensions (£10,000); P. Dalton, city engineer.

Cheetham.—Canteen, for E. Butterworth, Ltd.; A. J. Freeman, architect, 33, Barwell Road, Sale, Cheshire.

Rebuilding portion of tobacco factory, Derby Street; E. A. Newton, architect, Rutherford Chambers, Bow Lane.

Cockermouth.—British Restaurant; U.D.C. surveyor.

Croydon.—Shelters at 21 schools, and further restaurants (£10,000); borough engineer.

Partial reconstruction of town hall; Grace & Marsh, Ltd.

Darlington.—Canteen at Darlington Wire Mills. Works extensions; Sir W. Arrol & Co., Ltd., contractors, Glasgow.

Dewsbury.—Canteen at works; Wormalds & Walker, Ltd., Thornhill Road, Thornhill Lees.

Glasgow.—Workshop, 567, Shettleston Road, British Dyewood Co., Ltd.
Works additions, J. & A. Law.

Hanley.—Canteen, Hampton Street; Taylor, Tunnicliff & Co.

Haverfordwest.—British Restaurant at Salvation Army Hall (£900); borough surveyor.

Highworth.—Sewage works, for R.D.C.; A. H. S. Waters, consulting engineer, 25, Temple Row, Birmingham, 2.

Ilford.—Canteen; Harrison & Spooner, Ltd. Dormitory blocks; Walter Strong, Ltd.

Newton Heath.—Canteen and garage, for John Nicols Manufacturing Co.; W. Johnson & Son, architects, 27, Oldham Road, Miles Platting.

Newcastle-on-Tyne. — Canteen, St. Lawrence Road, for the Limmer Trinidad Asphalte Co.; Bewley & Scott, builders, Dunston-on-Tyne.

North Shields.—Extensions to premises, Borough Road; British Sailors' Society.

Northwich.—Fire station (£7,300) for R.D.C.; J. Birtwistle, surveyor, Whitehall, Hartford.

Oxford.—Kitchen, works canteen, for the University Press, Great Clarendon Street; T. H. Hughes.

South Shields.—Restaurant at St. Jude's Hall (£1,845); acting borough engineer.

Stockton-on-Tees.—Canteen, Bowesfield Lane, for Tarslag, Ltd., Stockton.—Timber canteen, Bowesfield Lane, for Athole G. Allen, Ltd., Stockton.

Sutton Coldfield.—School canteen, Minworth; borough engineer.

Tynemouth.—Restaurant (£876); borough engineer, 19, Howard Street, North Shields.

Wallsend-on-Tyne.—Canteen for Wallsend Slipway & Engineering Co., Ltd.; Alexander Anderson (Contractors), Ltd., Sutton Street, Newcastle-on-Tyne.

West Gorton.—Works extensions; H. Burke & Son, architects, Green Lane, Brook Street.

Woking. — British Restaurant, Bath Road; G. F. Hawkins, surveyor, Council Offices.

Wood Green.—Two restaurants; borough engineer.

Yorkshire.—Canteens at schools for the West Riding C.C. (£15,000); county architect, County Hall, Wakefield.

Machine Tool Capacity

THE deputy-chairman of the London & South-Eastern Regional Board, Production Executive (Mr. S. Marks) asks us to draw our readers' attention to the existence and work of the Machine Tool Capacity Clearing Centres whose services are available to works managers and others who encounter the problems of finding spare capacity or securing work for temporarily idle machines.

In the London and South-Eastern Region (London, Kent, Sussex and Surrey) there are ten Clearing Centres. They are in effect capacity exchanges, designed to do for manufacturing capacity what the Employment Exchanges do for labour. Each is in charge of a technical officer of the Board.

The Centres have a comprehensive register of the firms in their districts and of their machine tool facilities. They keep in touch with firms who have spare capacity for which they want work, even where the spare capacity may be available for short periods only. "Spare capacity" fluctuates from day to day, but the aim is to waste none of it that can be used to the national advantage. All this information is kept at the Clearing Centres in a simple but systematic way so that when a firm asks for assistance it can be put into touch with what it wants with a minimum of formality and delay. Needless to say, the business of fixing prices, deliveries, etc., is left to the two parties who have been introduced.

Altogether the Clearing Centres of the London and South-Eastern Regional Board effected over 2,000 successful introductions between January and July. In about three-quarters of these the value of the job was given, and they totalled over a million pounds, but this is entirely out of ratio with the unassessed value. The only true monetary value that could be put on these introductions is the total value of the contracts that would have been held up without them.

The Clearing Centres aim at fostering a friendly spirit amongst the firms in their districts. The technical officer in charge gets into close relations with the factory managers in his district and, Mr. Marks says, the danger of factory managers feeling they are going to run into "a fogbound maze of redtape-bestrewn blind alleys" is eliminated. There is then a much better chance of factory managers getting together amongst themselves and seriously co-operating with each other—which is just the object of the whole scheme, and there is far less chance of any capacity being overlooked.

All concerned are urged to get into touch with their local Clearing Centre at once. There is nothing to be lost since the service is free; the greater the number of new users, the better service everyone gets, with a widening of the scope of possible benefit to all. The addresses of the Clearing Centres in the London Region are as follows:—60a, High Street, Acton, W.3 (Acorn 5071); Equitable House, George Street, Croydon (Croydon 5189); 198, Fore Street, Edmonton (Tottenham 5481); 20, Court Road, Eltham, S.E.9 (Eltham 5588); 15, College Road, Harrow (Harrow 2602); Rooms 15 and 23, Cranbrook House, Cranbrook Road, Ilford, Essex (Ilford 0038); Room 429, 4th Floor, Romney House, Marsham Street, S.W.1 (Franklin 2211, Ext. 2680 & 2673); 32, High Street, Guildford; and Moat House, The Esplanade, Rochester (Strood 7276). The Sussex Centre is about to be opened.

The scheme is rapidly being extended to other Regions and provincial inquirers can get details from their respective Regional Boards.